LEARJET 75

AVIONICS

TECHNICAL TRAINING GUIDE

December 2014

BOMBARDIER
the evolution of mobility

BOMBARDIER AIRCRAFT TRAINING

Montreal Training Centre
8575 Côte-de-Liesse Road
Saint-Laurent, Quebec, Canada
H4T 1G5
Telephone (514) 344-6620
Toll-Free North America
1 (877) 551-1550
Fax (514) 344-6643

DFW Training Center
2929 West Airfield Drive
P.O. Box 619011
DFW Airport, TX 75261
Telephone (469) 791-4200
Toll-Free North America
1 (888) 679-4200
Fax (469) 791-4201

www.batraining.com
www.cic.bombardier.com

CHAPTER	TITLE
22-00-00	**Auto Flight**
22-10-00	Autopilot System
22-20-00 &	Mach &
22-25-00	Configuration Trim System
22-50-00	Rudder Boost System
23-00-00	**Communications**
23-10-00	VHF Communication System
23-12-00	HF Communication System
23-15-00	Iridium SATCOM System
23-20-00	SELCAL System
23-25-00	Controller-Pilot Datalink Communication
23-30-00	Passenger Address System
23-50-00	Audio Integrating System
23-60-00	Static Discharge System
23-70-00	Cockpit Voice Recorder System
25-00-00	**Equipment and Furnishings**
25-10-00	Flight Compartment
25-20-00	Passenger Compartment
25-30-00	Galley
25-40-00	Lavatory
25-50-00	Cargo Compartment
25-60-00	Emergency Equipment
25-61-00	Underwater Locator Beacon
25-62-00	Emergency Locator
25-80-00	Insulation
31-00-00	**Indicating and Recording**
31-01-00	Digital Data Buses
31-11-00	Instrument and Control Panels
31-30-00	Flight Data Recorder
31-40-00	Secure Digital Cards
31-41-00	Central Computing System
31-51-00	Engine Indicating and Crew Alerting Systems
31-53-00	Configuration Monitor System
31-60-00	Electronic Flight Instrument System

CHAPTER	TITLE
34-00-00	**Navigation**
34-10-00	Stall Warning System
34-11-00	Pitot-Static System
34-14-00	Radio Altimeter System
34-17-00	Air Data System
34-24-00	Electronic Standby Instrument System (ESIS)
34-27-00	Attitude Heading Reference System (AHRS)
34-31-00	Runway/Taxi Situational Awareness
34-42-00	Weather Radar System
34-43-00	Traffic Alert and Collision Avoidance System (TCAS II)
34-45-00	Terrain Awareness Warning System (TAWS)
34-46-00	Traffic Awareness and Warning
34-51-00	VHF Navigation System
34-53-00	Global Positioning System
34-55-00	Distance Measuring Equipment (DME) System
34-56-00	ATC Transponder System
34-57-00	Automatic Direction Finder (ADF) System
45-00-00	**Maintenance Information Systems**
46-20-00	**Flight Deck Information Systems**

This page intentionally left blank

TABLE OF CONTENTS

AUTO FLIGHT
(ATA 22-00-00)
OVERVIEW 1

AUTOPILOT SYSTEM
(ATA 22-10-00)
OVERVIEW 3
COMPONENTS 3
ASSOCIATED COMPONENTS 3
COMPONENT DESCRIPTION AND OPERATION 4
Autopilot Roll, Pitch, and Yaw Servos 4
Servo Mounts 8
Autopilot Mode Controller 8
Control Wheel Trim Switches 9
Control Wheel Master Switch 10
Touch Control Steering Switch 10
Go-Around Switch 10
Forward Interface Unit 11
Integrated Avionics Units 12
Display Units 13
Touchscreen Controllers 13
Autopilot Trim Adapters 14
Flight Director 16
Autopilot 18
Indications 18
SYSTEM OPERATION 21
FAULT INDICATION 34

MACH/CONFIGURATION TRIM SYSTEM
(ATA 22-20-00 and 22-25-00)
OVERVIEW 37
ASSOCIATED COMPONENTS 38
COMPONENT DESCRIPTION AND OPERATION 38
Integrated Avionics Units 38
Trim Adapters (2) 39
Stabilizer Actuator Control Box 41
Stabilizer Actuator 42
Trim System Select Switch 44

Control Wheel Trim Switch 44
Control Wheel Master Switch 45
Forward Interface Unit 46
Spoileron Computer 47
Air Data Computers 48
Flap Position Indication Unit 49
Configuration Trim System 49
Mach Trim Function 49
SYSTEM MONITORS 50
FAULT INDICATION 51

RUDDER BOOST SYSTEM
(ATA 22-50-00)
OVERVIEW 55
COMPONENTS 55
COMPONENT DESCRIPTION AND OPERATION 55
Integrated Avionics Units 55
Rudder Boost Switch/Indicator 56
Yaw Servo 57
Rudder Pedal Force Sensor 58
Forward Interface Unit 59
Yaw Force Interface Box 60
OPERATION 61
FAULT INDICATION 64

AUTO FLIGHT

(ATA 22-00-00)

OVERVIEW

Figures 1

The Learjet 70/75 auto flight system includes the following functions:

- Flight director
- Autopilot/yaw damper/autopilot trim
- Mach configuration trim
- Rudder boost

The flight director (FD) function uses two separate flight director systems installed in the no. 1 and no. 2 integrated avionics units. The flight directors control the lateral and vertical command bars on the primary flight display (PFD), dependent upon pilot mode selection on the autopilot mode controller.

The Learjet 70/75 autopilot/yaw damper function comprises a dual-channel digital autopilot, which may be coupled to either of two flight directors. The autopilot function is distributed between the no. 1 and no. 2 integrated avionics units, and the pitch and roll servos. The autopilot controls the aircraft, based on the selected control mode and guidance inputs, via servo control of the elevator, ailerons, and rudder. The autopilot trim function uses the horizontal stabilizer control system to relieve a constant pressure on the elevator servo. When the autopilot is engaged, the autopilot trim mode has priority over all other automatic pitch trim modes.

The Mach/configuration trim functionality is contained in the no. 1 and no. 2 integrated avionics units. The Mach trim system provides closed-loop horizontal stabilizer position control when the autopilot is not engaged. When the system is operating, the control loop provides relative stabilizer position changes based on changes in the Mach number above 0.725 Mach. The configuration trim system provides automatic adjustments to the horizontal stabilizer based on inputs from the flaps and spoilers.

The rudder boost function automatically assists the crew when extreme rudder-pedal force is required to maintain directional control of the airplane. It is not used to maintain directional control of the aircraft under normal conditions. On the ground, it interfaces with the nosewheel steering computer.

This chapter is divided into the following sections:

- Autopilot ATA 22-10-00 (Includes yaw damper and flight directors)
- Mach/Configuration Trim ATA 22-20-00 and ATA 22-25-00
- Rudder Boost ATA 22-50-00

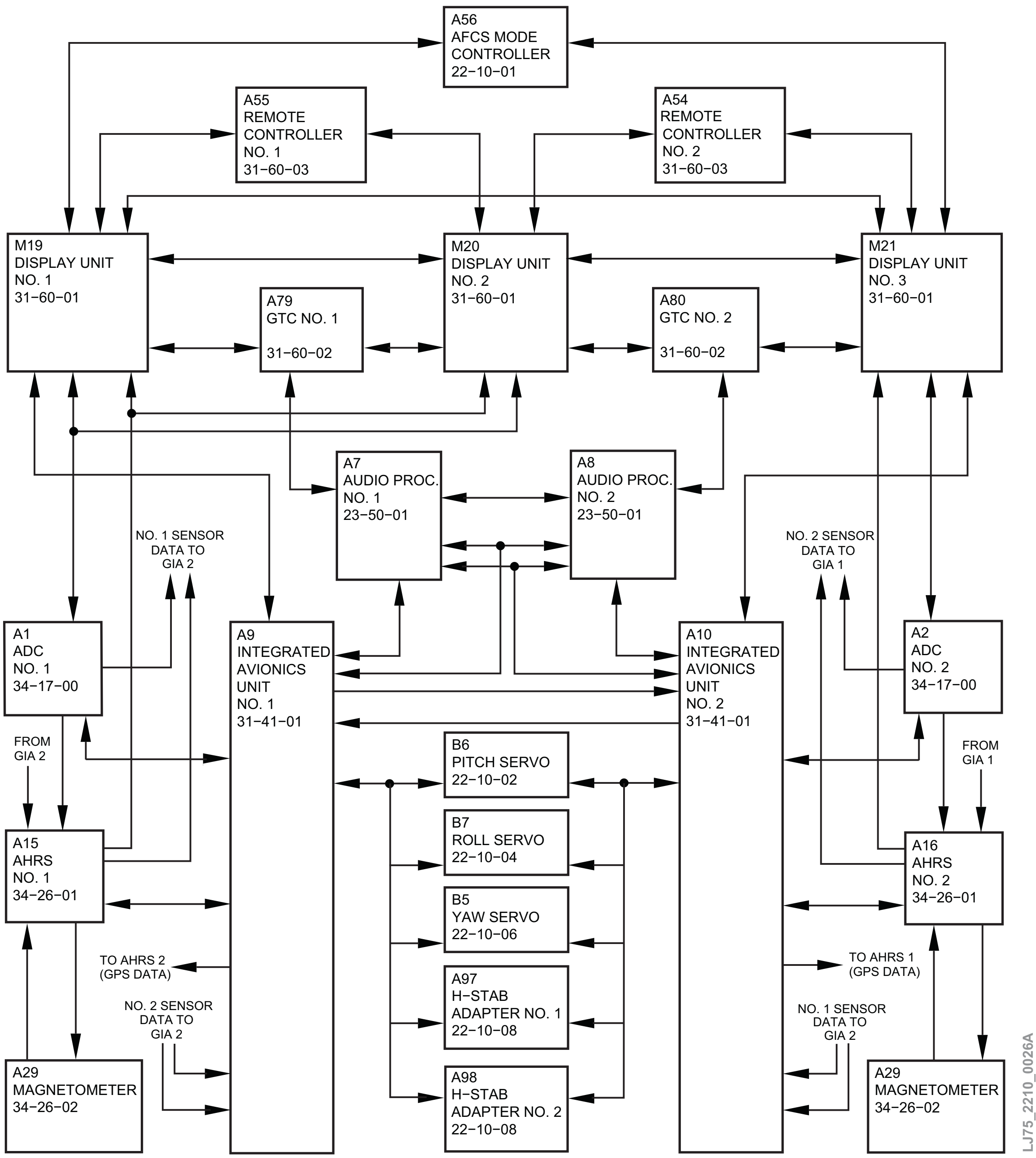


Fig. 1: Learjet 75 Autopilot System Block Diagram

AUTOPILOT SYSTEM

(ATA 22-10-00)

OVERVIEW

The Learjet 70/75 autopilot system includes the yaw damper functions and is composed of a dual-channel digital autopilot and two flight directors. The autopilot may be coupled to either of the two flight directors.

The autopilot function is distributed between the integrated avionics units and the pitch servo, and roll servo. The yaw damper function is provided by the integrated avionics unit and the yaw servo. The autopilot and yaw damper control the flight of the aircraft, based on the selected control mode and guidance inputs, via servo control of the elevators, ailerons, and rudder.

When engaged, the autopilot automatically commands trim changes on the elevator, as required. It also allows control surface commands for the ailerons and elevators to be entered via the control wheel trim switches (CWTS). Selection of manual trim on either CWTS disconnects the autopilot. The touch control steering (TCS) feature allows the crew to manually maneuver the aircraft with the autopilot engaged when the TCS switch is pressed.

The flight director system controls the lateral and vertical command bars on the primary flight display (PFD), dependent upon pilot mode selection on the autopilot mode controller. The flight director computers (resident in each integrated avionics unit) receive and process pitch, roll, acceleration, attitude, air, and navigational data for display.

COMPONENTS

The autopilot system contains the following components:

- Autopilot pitch, roll, and yaw servos (3)
- Servo mounts (3)
- Autopilot mode controller
- Control wheel trim switches (CWTS) (2)
- Control wheel master switches (MSW) (2)
- Touch control steering (TCS) switches (2)
- Go-around switch

ASSOCIATED COMPONENTS

- Forward interface unit
- Integrated avionics units (2)
- Display units (3)
- Touchscreen controllers (2)
- Autopilot pitch trim adapters (2)

COMPONENT DESCRIPTION AND OPERATION

Autopilot Roll, Pitch, and Yaw Servos

Figures 2, 3, and 4

Three servos are installed. The autopilot yaw and pitch servos are located in the aft fuselage, and the autopilot roll servo is installed in the wing. The three servos are used for the automatic control of pitch, roll, and yaw. These units interface with both integrated avionics units via RS-485.

.

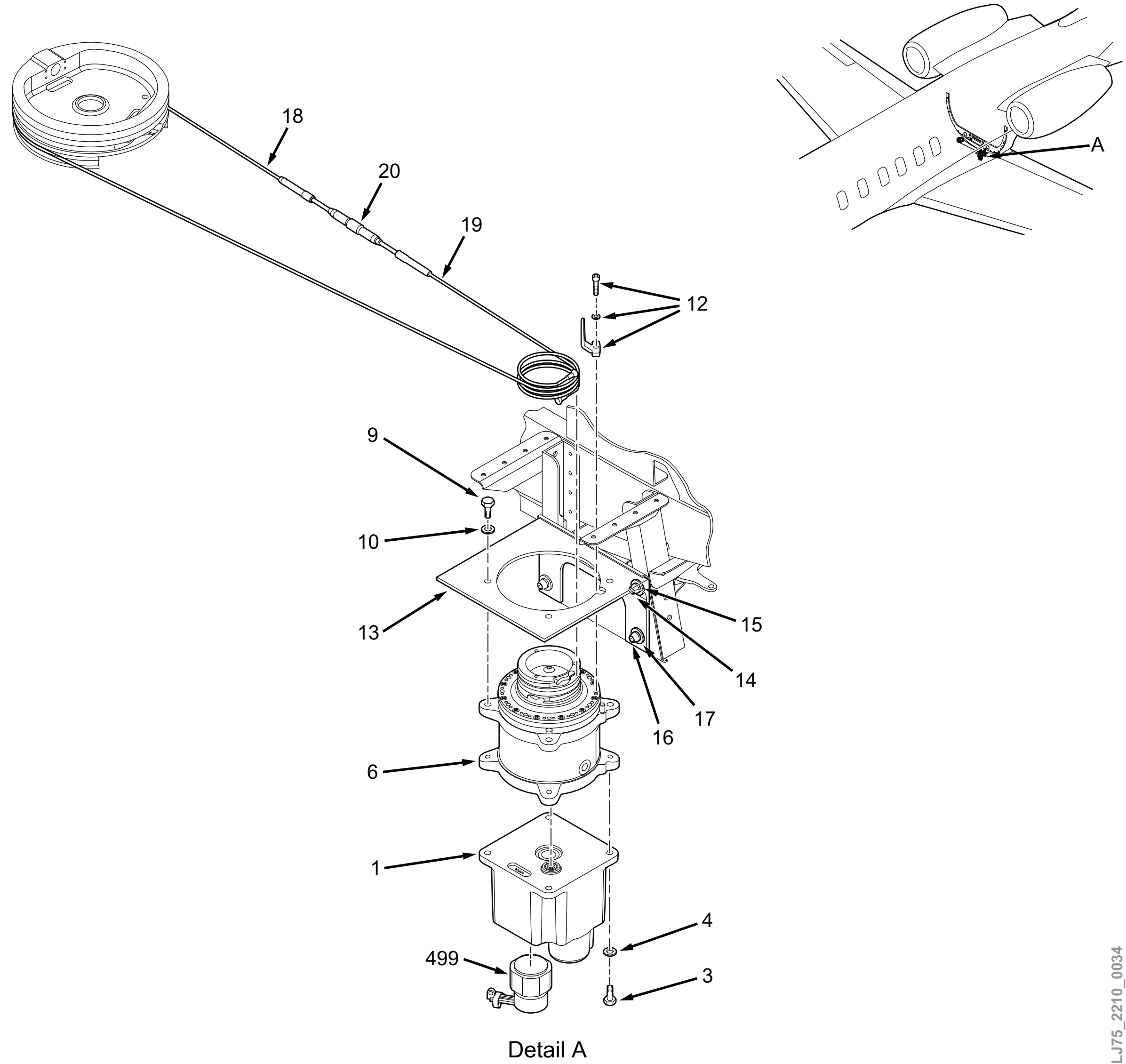


Fig. 2: Autopilot Roll Servo

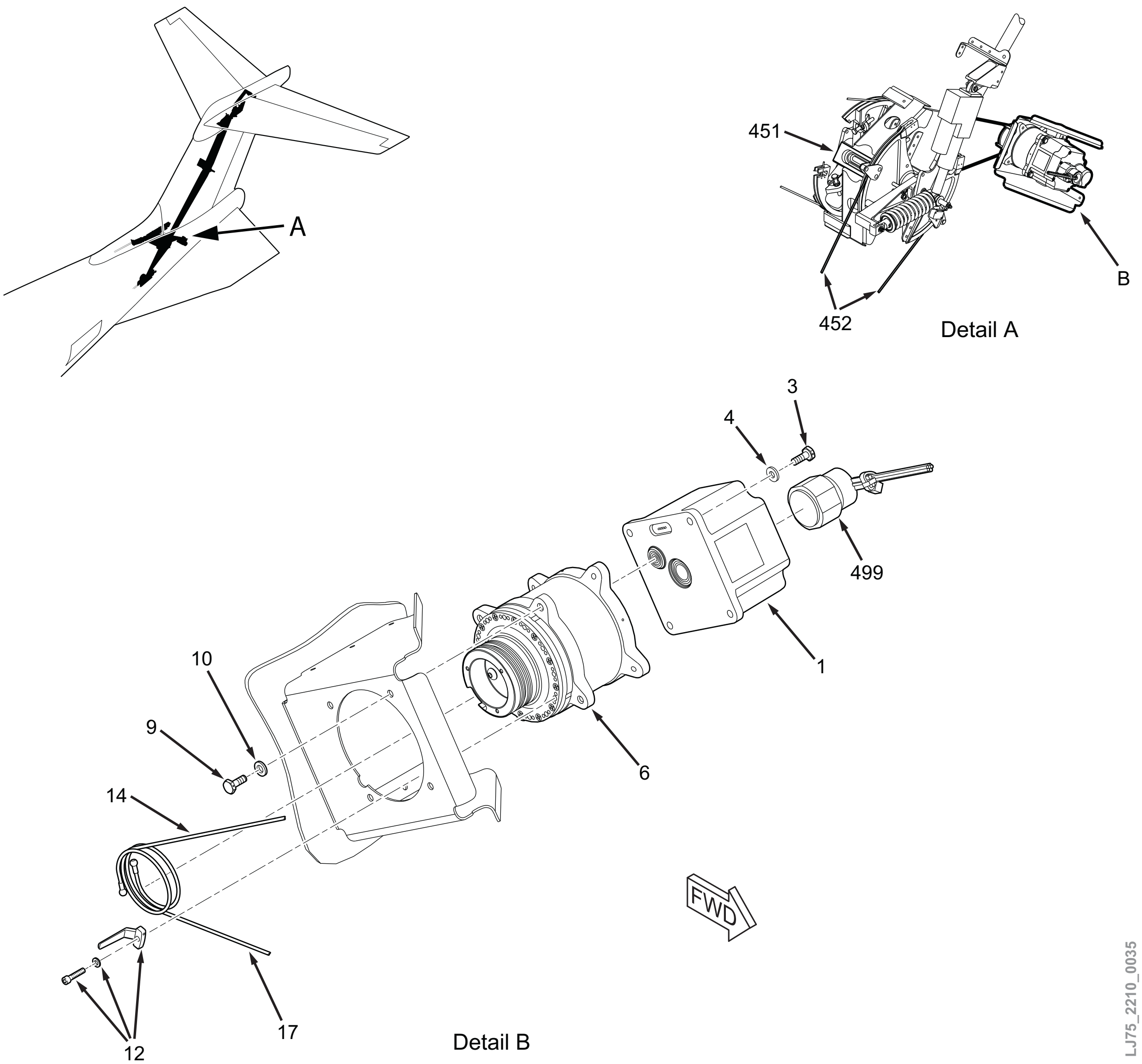


Fig. 3: Autopilot Pitch Servo

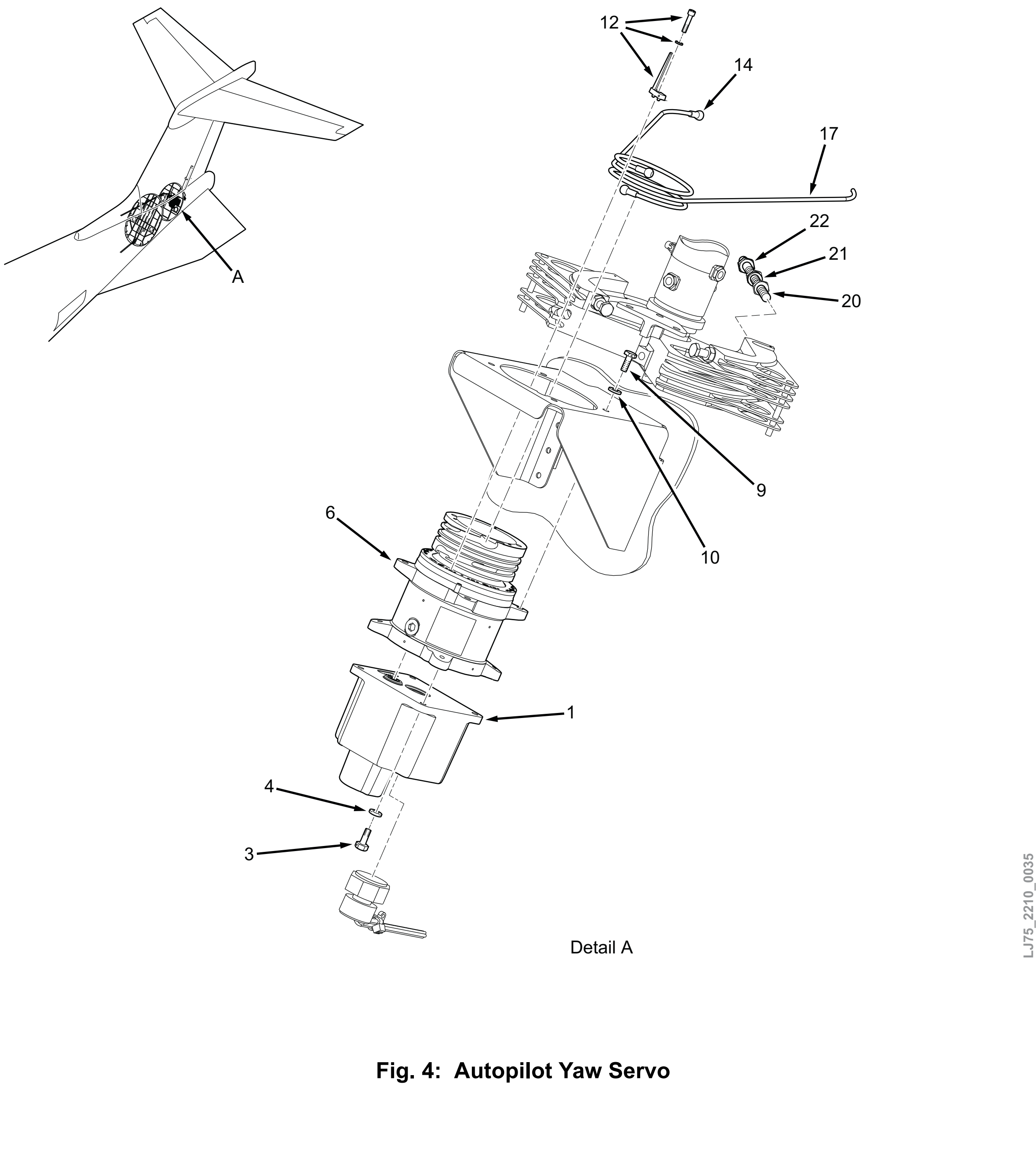


Fig. 4: Autopilot Yaw Servo

Servo Mounts

Figures 2, 3, and 4

Three servo mounts are attached to a mount bracket of each autopilot servo and are responsible for transferring the output torque of the autopilot servo to the mechanical flight control surface linkage.

Autopilot Mode Controller

Figure 5

The GMC is the prime controller for the flight director and the autopilot/yaw damper. The GMC provides the means, via ON/OFF pushbuttons, for flight director mode selection, couple status, and autopilot/yaw damper engagement selection. All flight director modes engage status is indicated via a green annunciator on the top of each mode pushbutton switch.

That annunciator illuminates when the mode is active. The controller also has several rotary controls to enable the selection of IAS and MACH targets, altitude, course, and heading. In addition, a SPD switch allows the crew to select FMS or MAN. The SPD switch also has a pushbutton function to allow the crew to select IAS or MACH. The GMC interfaces with both display units and both integrated avionics units. All pushbutton selections are signaled to the display units via a RS-232 output from the GMC. The display units communicate with the integrated avionics units via HSDB.

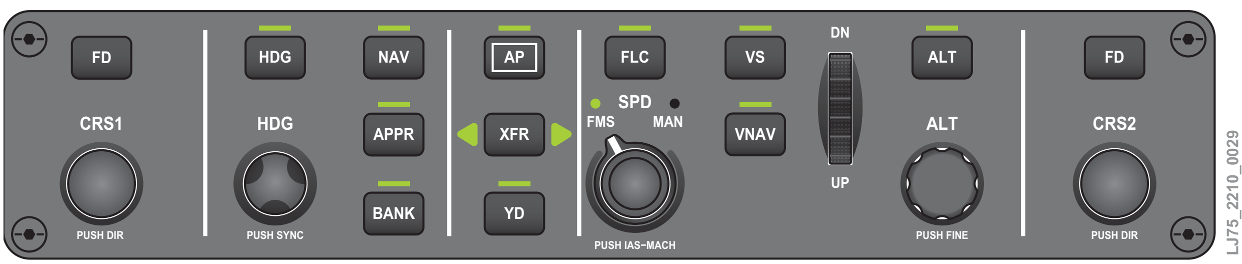


Fig. 5: Autopilot Mode Controller

Control Wheel Trim Switches

Figure 6

The control wheel trim switch (CWTS) consists of a barrel portion and a center arming button. When the autopilot is engaged, moving the barrel portion of the CWTS without pushing the center arming button controls pitch and roll commands. Switch control is dependent upon which flight director is coupled to the autopilot. Manual autopilot commands are not allowed when localizer and/or glideslope is captured in the respective axis.

Moving the barrel portion left or right cancels any captured lateral modes and reverts to roll hold (ROL). Moving the barrel portion up or down cancels any captured vertical mode and reverts to the basic pitch (PIT) mode.

To initiate manual primary pitch trim or roll trim commands, press and hold the center button while moving the barrel portion. This immediately disengages the autopilot. The yaw damper and flight director modes are not affected by manual pitch or roll trim commands.

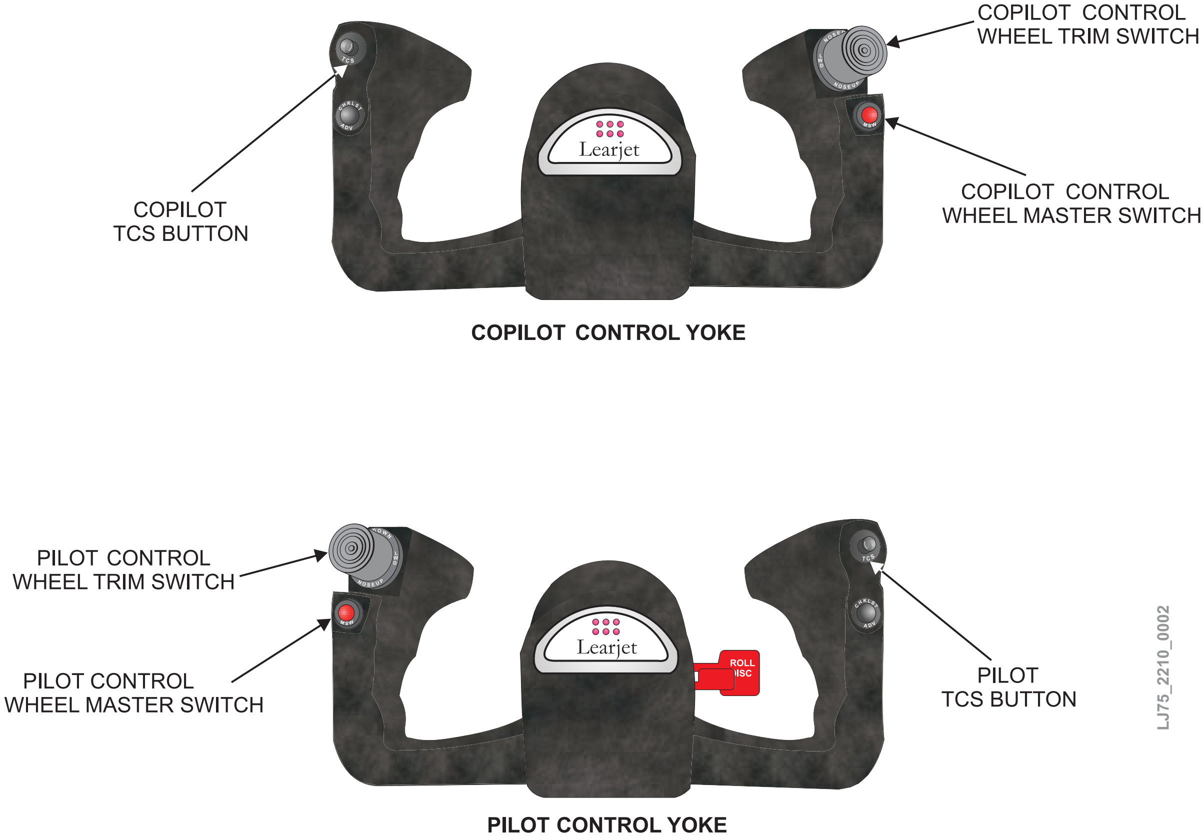


Fig. 6: Control Wheel Switches

Control Wheel Master Switch

Figure 6

The control wheel master (MSW) switch immediately disconnects all autopilot and yaw damper servo drives. The selected flight director modes are not affected.

Touch Control Steering Switch

Figure 6

Touch control steering (TCS) switch allows the pilot to manually fly the airplane without disengaging the autopilot. To use the TCS function, the pilot presses the TCS button on the control wheel, maneuvers the aircraft to the desired condition, and releases the TCS. Operation of the TCS button has no effect on flight director mode of operation.

Go-Around Switch

Figure 7

The go-around (GA) switch is located on the left outboard side of the throttle levers.

When the aircraft is in the air, selection of the GA button disconnects the autopilot (but not the yaw damper) and cancels all other vertical and lateral modes except automatic altitude preselect arm. The flight director provides a wings-level command bar display in the lateral axis and 9° pitchup vertical command.

When the aircraft is on the ground, selection of the GA button operates as a takeoff mode.

The flight director provides a wings-level command ar display in the lateral axis and 9° pitchup vertical command.

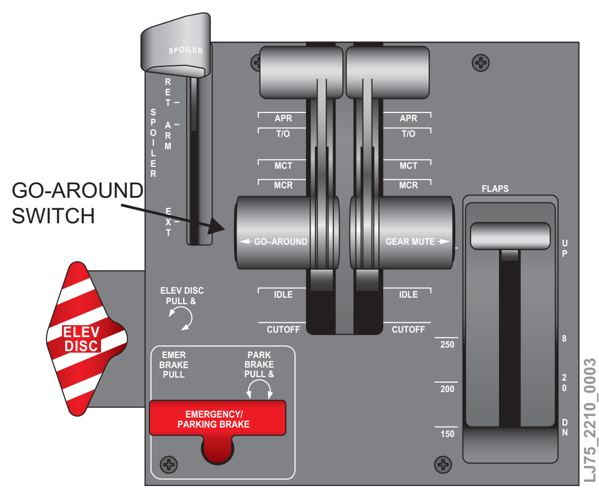


Fig. 7: Go-Around Switch

Forward Interface Unit

Figure 8

The forward interface unit (FIU) is located in the forward avionics bay on the pilot side. In addition to the autopilot, several other systems use the FIU. Many relays related to the autopilot, ELEV/AP DISC, and AIL/ AP DISC are installed in this unit.

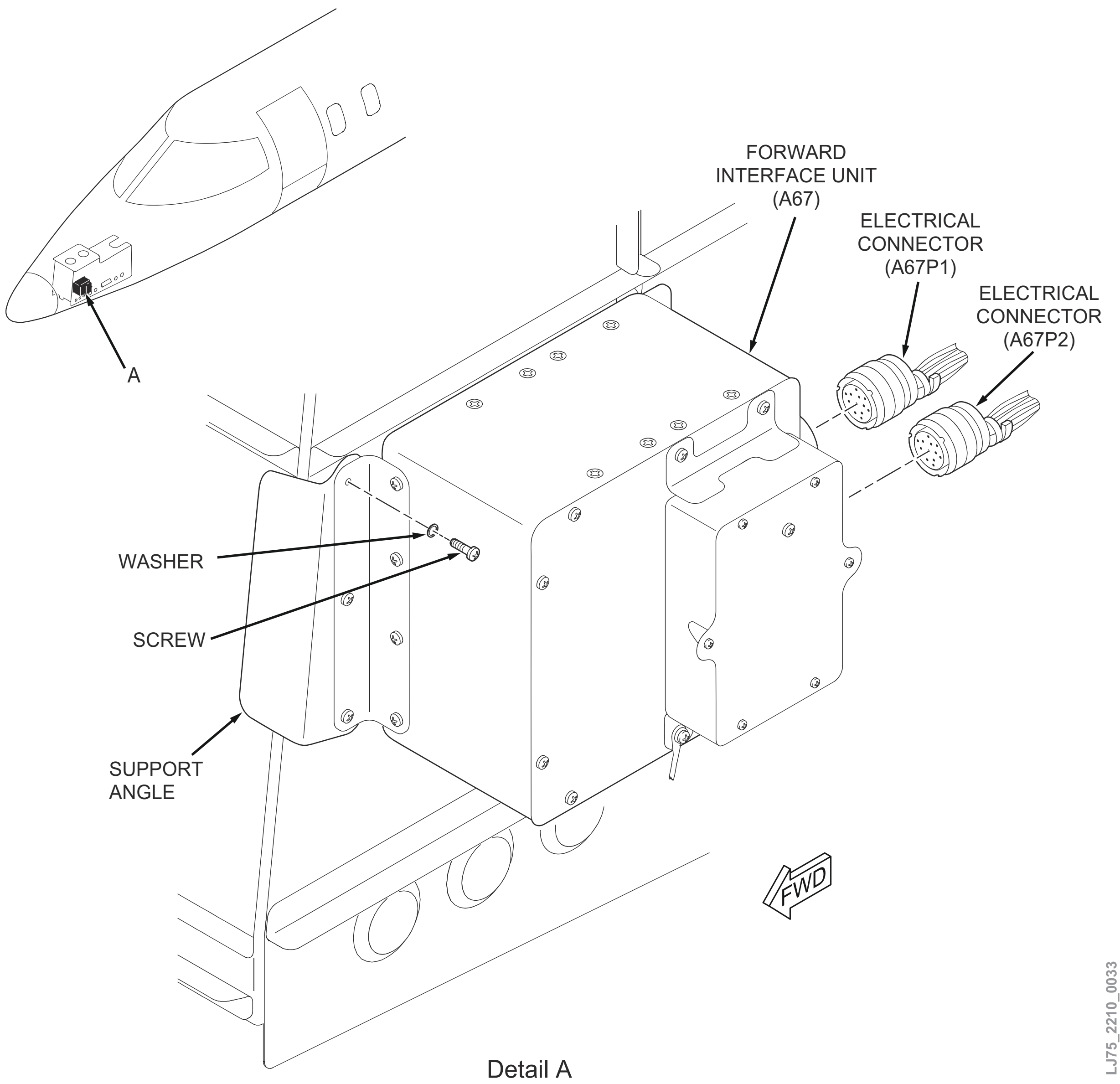


Fig. 8: Forward Interface Unit

Integrated Avionics Units

Figure 9

Two integrated avionics units are forward of the instrument panel. The units are the primary LRU of the Bombardier Vision Flight Deck*. The autopilot is active in both the no. 1 and no. 2 position and can couple to either unit flight director. The autopilot has the ability to control the aircraft using the elevator, and roll and yaw servos, as well as the horizontal stabilizer trim.

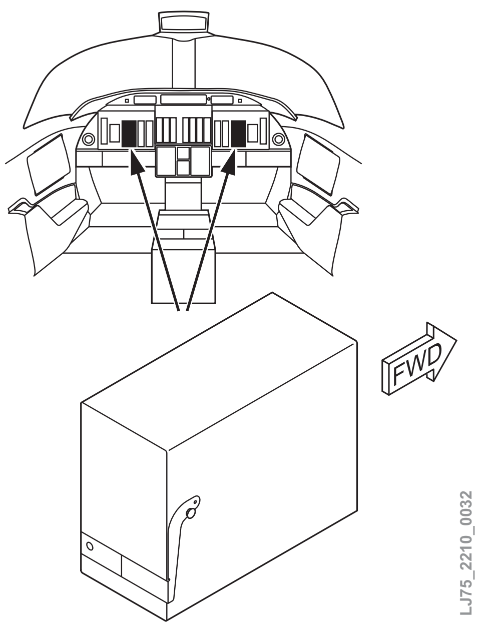


Fig. 9: Integrated Avionics Unit

Display Units

Figure 10

The displays are configured as two PFDs and one MFD.

VOR, ILS, and FMS flight director mode engagement is dependent upon the NAV/GPS source softkey located on the touch controller. The VOR and ILS modes (VOR, VAPP, LOC, BC, GS) are selectable when the NAV source select switch is in NAV. The FMS modes (LNAV, VNAV) are selectable when the NAV source select switch is in GPS and the FMS is programmed with valid NAV data.

Fig. 10: Display Units

Touchscreen Controllers

Figure 11

Touch controllers are used for NAV tuning, FMS functions and various FD settings.

Fig. 11: Touchscreen Controller

Autopilot Trim Adapters

Figures 12 and 13

Two GTAs are installed in the aft fuselage. The GTAs are used for the automatic trim for pitch, roll, and/or yaw. These units interface the horizontal stabilizer actuators with both integrated avionics units via the RS-485.

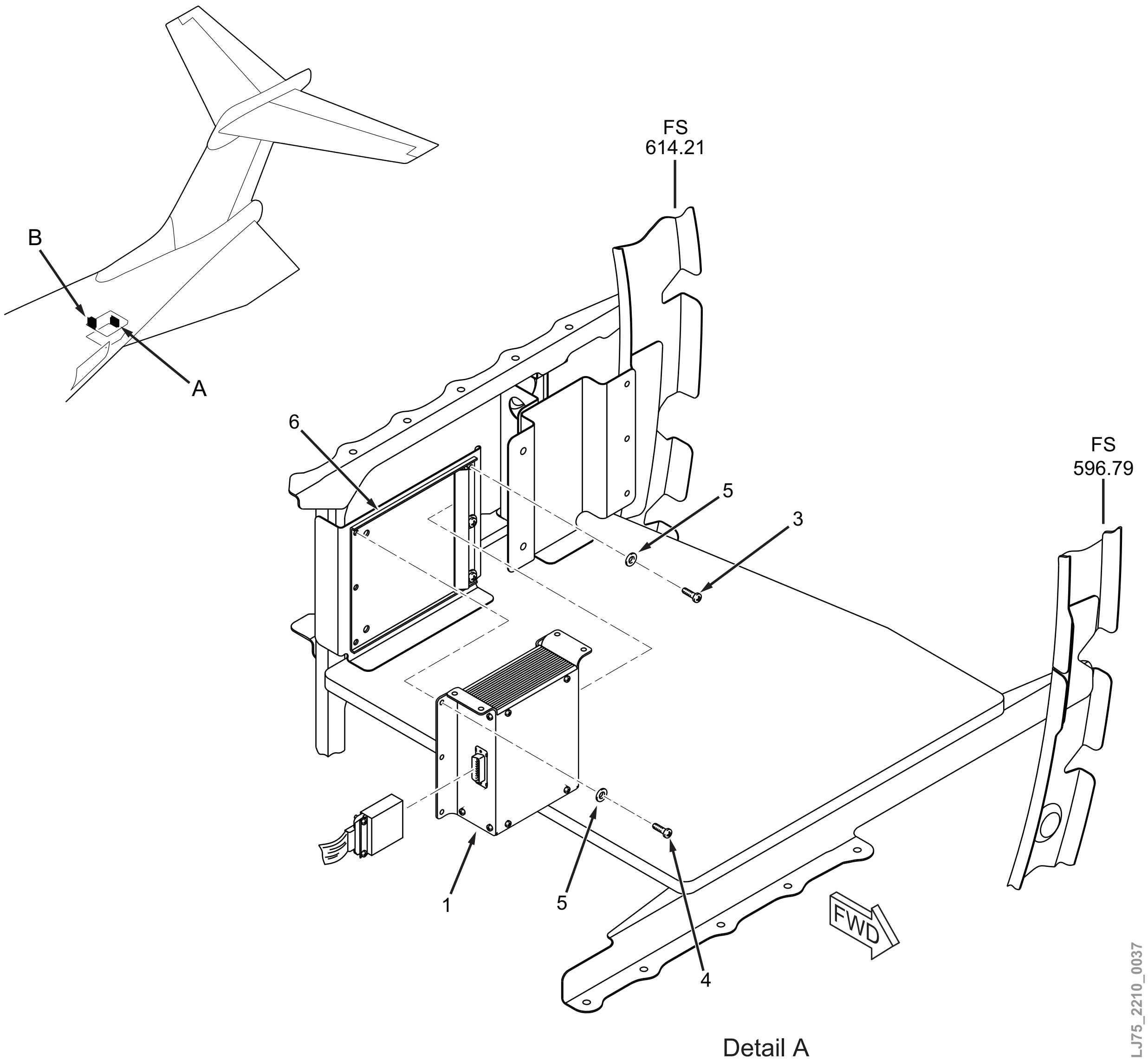
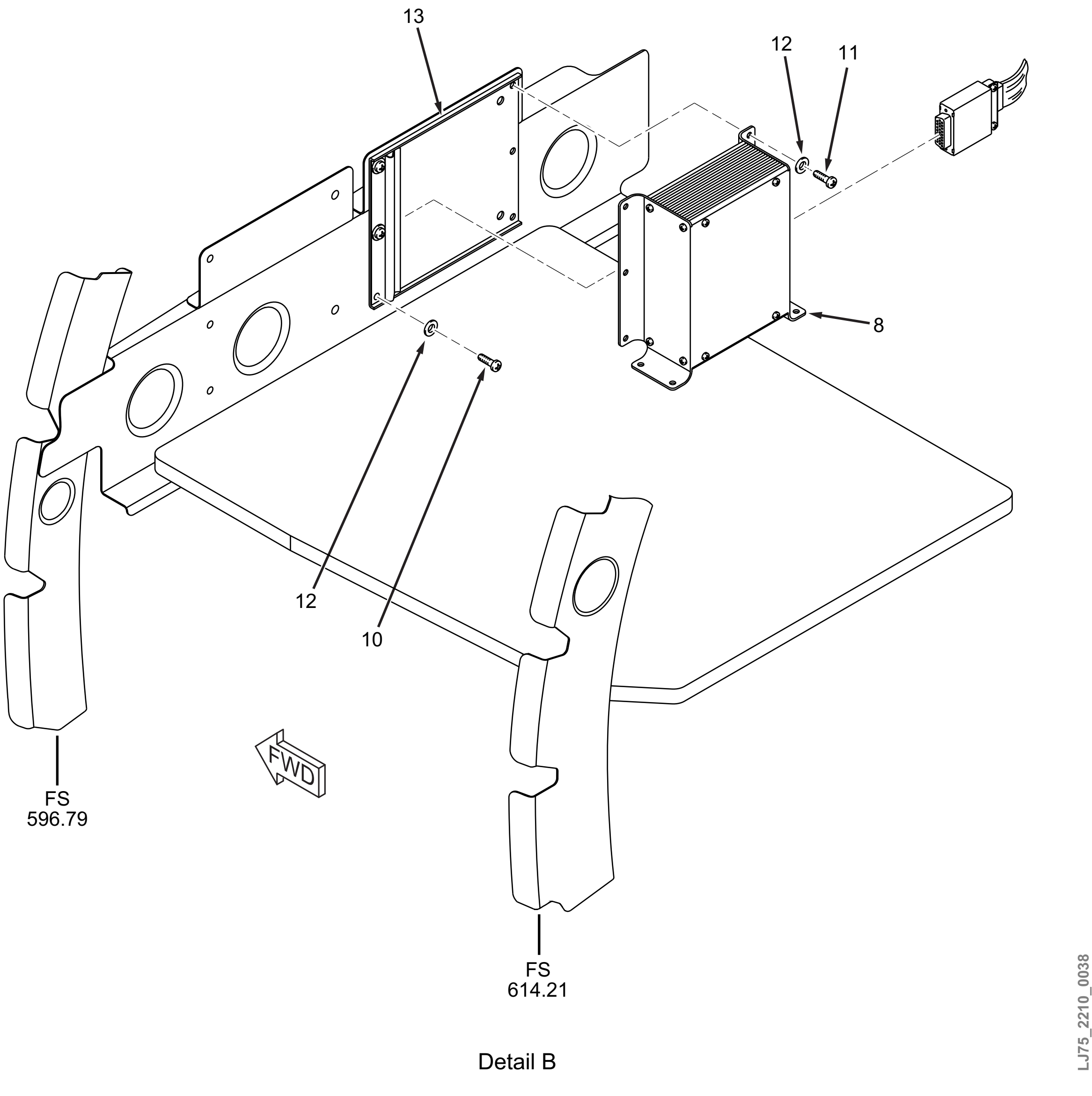


Fig. 12: Autopilot Trim Adapters (1 of 2)



Detail B

Fig. 13: Autopilot Trim Adapters (2 of 2)

Flight Director

Figure 14

The flight director provides dual flight director coupling capability to either the pilot or copilot PFD, steering commands to the AFCS, and the ability to couple to the flight management system.

The flight director only requires pitch or roll for synchronizing the attitude command and for computing the command-bar outputs. When the modes are selected, the attitude data is always used for synchronization and command-bar computations. The electronic flight instrument system (EFIS) function uses the flight director attitude command to position the command bar on the attitude sphere for steering commands to the flight crew.

The flight director uses heading data for heading hold mode, independent of which heading source is being shown on the EFIS.

The flight director can couple to short-range navigation (SRN) units (e.g., VOR, ILS), dependent upon which SRN is being shown as a NAV source on the HSI. The flight director uses the shown SRN data for the command-bar control computations.

The preselected altitude, altitude hold target, airspeed target, Mach target, vertical speed target, and low-bank select are all computed by the integrated avionics unit.

Each flight director uses air data from the air data computer (ADC) source that is shown. The flight director uses default values of true airspeed and indicated airspeed, for lateral mode gain programming, if its onside air data is invalid.

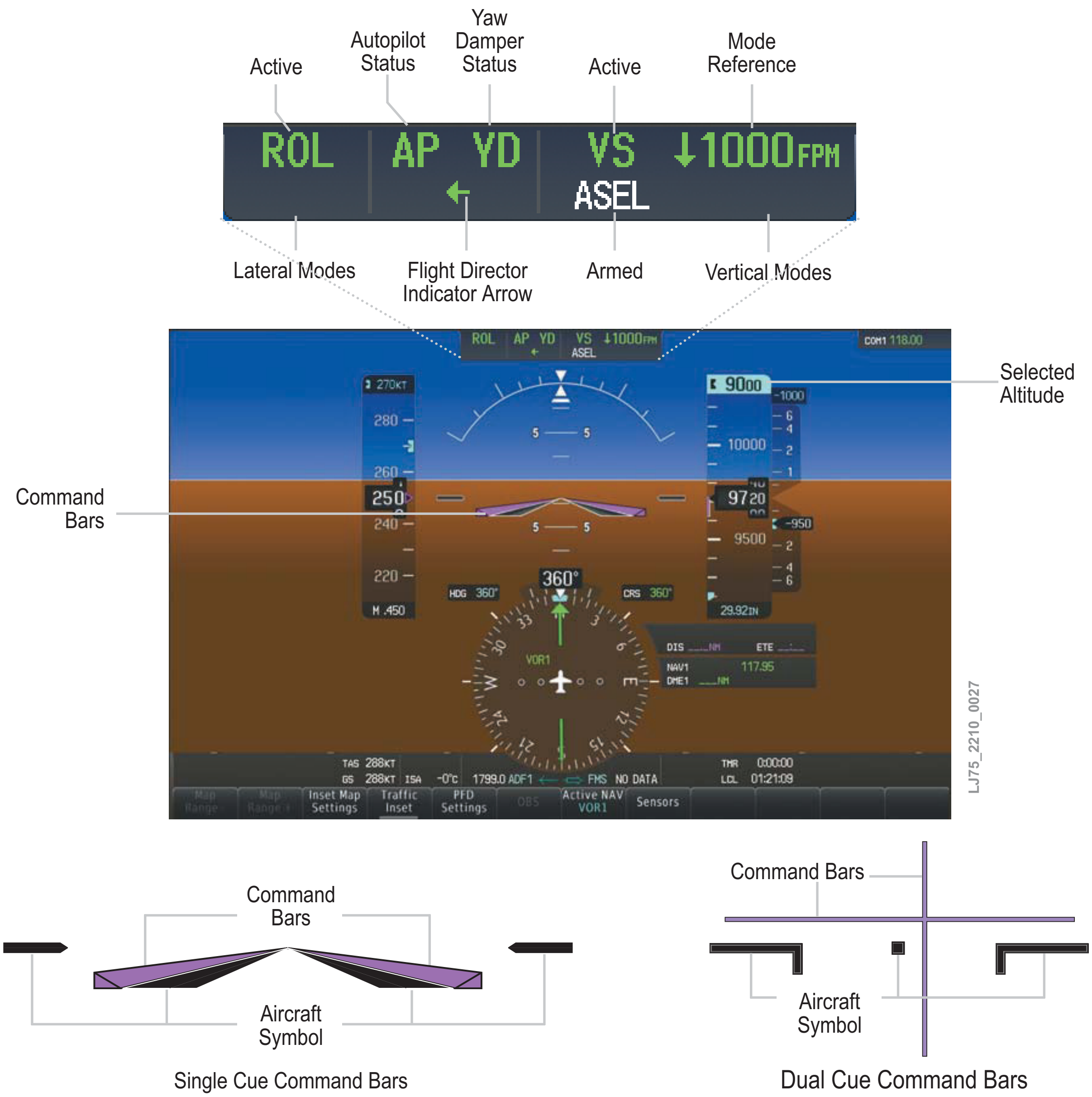


Fig. 14: Flight Director

Autopilot

The autopilot provides pitch attitude, roll attitude, and yaw control via servo control of the elevator, ailerons, rudder, and elevator trim. The autopilot servo power gear ratios provide sufficient authority for optimum autopilot performance, but also limit the authority below a value where a saturated servo amplifier output or an oscillatory servo response could overstress the aircraft structure.

The autopilot always tracks the pitch and roll attitude commands from the flight director. This includes operation in the flight director standby condition (pitch hold, heading hold, roll hold). The autopilot processor is not aware of the flight director modes and does not alter gains or modes of operation as a function of flight director modes.

The yaw damper computes servo commands based on sensor input data only. The yaw damper provides yaw rate damping only and does not control the flight path of the aircraft. The yaw damper assists in turn coordination. The servo position reference is synchronized to zero at engagement and is constantly updated to make sure that the steady state rudder forces are zero. A fly-through feature of the yaw damper is active below 150 KIAS. This updates the yaw damper rudder pedal input, allowing the yaw damper to remain engaged on approach with little force impeding the pilot.

Indications

Engine Indication and Crew Alerting System

ELEV MISTRIM is annunciated as a caution message (amber) on the engine indication and crew alerting (EICAS) when the integrated avionics computer detects elevator servo loads that have not been relieved by the pitch trim system. The ELEV MISTRIM message indicates control wheel forces may be high when the autopilot is disengaged.

The AIL MISTRIM amber caution message is illuminated on the EICAS when the integrated avionics computer detects aileron servo loads that have not been relieved by the aileron trim system. The AIL MISTRIM message indicates control wheel forces may be high when the autopilot is disengaged.

Electronic Flight Information System (EFIS)

Table 1

Lateral modes for the AP/FD are shown on the top left side of the PFD. Vertical modes are shown on the top right side of the PFD. Armed lateral modes are shown in white directly to the left of the captured modes. Armed vertical modes are shown in white directly to the right of the captured modes. The modes are displayed in the same layout as the selections on the mode controller.

The MAXSPEED overspeed caution annunciation is shown on the left side of the attitude sphere when the flight director detects an overspeed condition. The annunciation is shown as long as the flight director determines the overspeed condition exists.

The following annunciations illuminate on the PFD for the flight director/autopilot:

Table 1 - AFCS Status Box Messages

LOCATION	ANNUNCIATION	INDICATION
Center (Engagement Mode	AP	Autopilot active, normal
	AP	Flashing: autopilot disengaged (system)
	AP	Flashing (for 5 seconds): autopilot disengaged (crew)
	YD	Yaw damper active, normal
	YD	Flashing (for 5 seconds): yaw damper disengaged
	TCS	Momentary: Touch control steering engaged
	←	Flight director indicator arrow—pilot-side flight director selected
	→	Flight director indicator arrow—pilot-side flight director selected
Left (Lateral Mode)	ROL	Basic roll
	HDG	Heading
	VAPP	VOR approach
	LOC	Localizer
	FMS	Long range nav
	VOR	VOR nav
	BC	Back course
	TO	Depressing the GA button on the throttle selects the flight director to take off (on the ground—flight director only)
	GA	Depressing the GA button on the throttle selects the flight director to go-around (in-air—flight director only). If an approach procedure is loaded, this button activates the missed approach when the selected navigation source is FMS, or when the navigation source is VOR/LOC and a valid frequency has been tuned.

Table 1 - AFCS Status Box Messages (Continued)

LOCATION	ANNUNCIATION	INDICATION
Right (Vertical Mode)	ASEL	Altitude preselect
	GS	Glideslope
	GP	Glide path
	ALT	Altitude hold
	VS	Vertical speed
	IAS	Indicated airspeed
	GA	Go around (flight director only) *See lateral mode GA
	TO	Takeoff (flight director only) *See lateral mode TO
	MACH	Mach
	PATH	VNAV tracking vertical descent
	VALT	Captures selected VNAV altitude reference
	FLC	Flight level change
	FLCH	Flight level change high
	PIT	Pitch hold

Table 2 - Autopilot Aural Alerting

AURAL ALERT	DESCRIPTION
AP Abnormal Disconnect Tone	Activated when the autopilot is disengaged for any reason other than a crew commanded disengagement, such as a monitor trip. It consists of a continuous cavalry charge (3 cavalry tones repeating with a brief pause in between) until canceled, and is accompanied by a red flashing AP indication on both PFDs until canceled and an amber flashing YD on both PFDs for approximately 5 seconds.
AP Normal Disconnect Tone	Activated when the autopilot is disengaged by a crew command using either CWMS, AP button on the autopilot mode controller, or when the crew commands manual pitch or roll trim commands with the autopilot engaged. It consists of three cavalry charge tones played one time. It is accompanied by amber AP and YD indications (on the PFD formats) that flash for approximately 5 seconds before extinguishing.
Trim-in-Motion Clacker	Activated when the autopilot is engaged and the trim is in motion for more than 2 to 3 seconds.

SYSTEM OPERATION

Figure 15

During normal operation, the following autopilot mode controls performs many functions.

Fig. 15: Autopilot Controls

CRS 1 rotary knob with integral pushbutton—Knob (course symbol on the face) controls the course display on the PFD 1 and provides the course to the flight director/ autopilot for the VOR and LOC modes. The roll flight director command is proportional to the course error. The course error signal is gain-programmed as a function of the airspeed and distance from the station. Pushing the CRS knob synchronizes the display to the aircraft "direct-to" course.

FD switch—Pushing the FD switch only does not bring the pilot flight director command bars into view. Any subsequent flight director mode selection (pitch or roll axis) causes both the horizontal and vertical command bars to be shown (the pitch or roll axis not selected engages attitude hold). When the flight director command bars are in view on both PFDs, the first FD switch pushed will remove the command bars from that side only. Pushing the opposite side FD switch disengages all flight director selected modes (AP not engaged).

The primary function of the FD switch is to bias the FD command bars out-of-view on their respective displays. Exceptions to this function are as follows:

- **AP engaged—**When the autopilot is engaged, the coupled-side flight director command bars are shown; the uncoupled-side flight director may continue to be toggled on/off with the FD switch
- **AP disengaged—**If FD mode is selected and either of the FD command bars are selected OFF, the command bars on the side selected will be biased out of view; if the other is selected OFF at this time (both FD command bars are selected OFF), then all FD modes will be canceled and will not be shown; if no FD modes are selected, no command cue is shown

AP switch/annunciator—Engages or disengages the autopilot.

When the switch is activated, the green bar on the top of the switch illuminates, the yaw damper engages, and the green light on the right side of the YD switch illuminates.

When the switch is deactivated, the yaw damper will not disengage. The green bar on right side of the AP switch extinguishes when the AP command is deselected or the monitor trips the mode offline.

When the switch is activated, the autopilot is coupled to the flight director selected by the XFR switch. If the onside FD was not ON prior to AP selection, the autopilot will engage in basic attitude and wings-level mode if the aircraft is within 6° of level. If the aircraft roll attitude is greater than 6°, the aircraft will maintain that attitude.

PIT and ROL will be annunciated when the basic attitude is engaged. If the altitude is different than the selected altitude when the autopilot is engaged, and the aircraft has a vertical rate toward the preselect altitude, the altitude preselect automatically arms and the aircraft will climb/descend toward it.

When the autopilot is engaged, the coupled-side flight director always shows the command bars. The side that is not coupled to the autopilot can deselect the command bars by pushing the corresponding FD switch.

The green AP YD annunciates on the PFD when the autopilot is engaged.

NOTE

The autopilot can only be engaged if both AHRS are valid.

The following actions disengage the autopilot:

- Control wheel master switch activation

- Pilot-initiated trim commands with arming switch pushed
- Secondary trim switch activation
- AHRS select switch with one AHRS inoperative
- Yaw damper disengagement
- Autopilot primary or secondary monitor trip
- Selecting pitch trim off

YD switch/annunciator—Engages or disengages the yaw damper.

When the switch is activated, the green bar on the top of the switch illuminates. The yaw damper automatically engages when the autopilot is engaged and remains engaged when the autopilot is disengaged using the AP switch (or pilot AP disconnect using the CWTS).

When the switch is activated, the green bar extinguishes when the yaw damper is deselected or the monitor trips the mode offline.

With the autopilot engaged, switch deactivation disengages the yaw damper and autopilot.

The following actions disengage the yaw damper:

- Control wheel master switch activation
- YD switch on the FGAC panel
- Autopilot primary or secondary monitor trip

XFR switch/annunciator—Transfers the flight director to the coupled autopilot.

When autopilot is not engaged, the XFR switch annunciates which side flight director is coupled to the autopilot.

A left green triangle indicates the autopilot is coupled to the no. 1 (left) flight director. The right green triangle indicates the autopilot is coupled to the no. 2 right flight director.

When the controller is initially powered, it defaults and illuminates the left green triangle. When the autopilot is engaged, the left or right green triangle indicates which side flight director is coupled to the autopilot.

When the autopilot is engaged, the XFR switch selection does not disconnect the autopilot.

HDG rotary knob with integral pushbutton—Knob (heading symbol above it) controls the heading bug and digit display on both PFDs.

The sync function is activated by pushing the HDG control knob, causing the pointer to align with the current heading on both PFDs (the pointer syncs to the side heading indicated by the XFER arrow).

The flight director and autopilot turn to follow the heading bug turn direction, up to a full 360° (smart heading bug). When the smart heading select mode is activated, the flight director steering command is either the shortest distance to the bug or in the direction of travel of the bug from the fore lubber line.

HDG switch/annunciator—Couples heading select mode to both no. 1 and no. 2 flight directors.

When the switch is selected, the green bar on top of the switch illuminates. The green bar extinguishes when the heading mode is deselected or the monitor trips the mode offline.

With the switch selected, previously selected lateral modes are canceled, the roll flight

director command is proportional to the heading select error, and the heading select error signal is gain-programmed as a function of airspeed.

When the heading select mode is active, HDG is illuminated on the EFIS.

The following actions disengage the heading select mode:

- Deselect HDG mode;
- LOC, BC, VOR, VAPP capture
- Go-around selected
- Shown heading source invalid
- Roll command from trim barrel switch in use with autopilot

BANK switch/annunciator—While in heading mode, selects a reduced maximum bank angle of 14° to both no. 1 and no. 2 flight director.

The normal bank angle limit during heading select is 27°. When the switch is selected, the green bar on the top of the switch illuminates. The green bar extinguishes when the heading select low bank submode is deselected or the monitor trips the mode offline.

NAV switch/annunciator—Activation of the NAV switch couples NAV commands (from VOR, LOC, or GPS) to both no. 1 and no. 2 flight directors.

When the switch is selected, the green bar on the top of the switch illuminates. The green bar extinguishes when the NAV mode is deselected or the monitor trips the mode offline.

NAV coupling is dependent upon the navigational source selected through the respective DU.

- **VOR mode—**Selected by pushing the CDI/GPS softkey on the DU with the navigation receiver tuned to a VOR frequency
  - When outside the lateral bracket sensor trip point, the roll flight director command is a heading select command as described in the HDG section
  - Upon reaching the lateral bracket sensor trip point, the system automatically switches to the VOR mode to capture and track the VOR beam; if the DME is valid, the VOR deviation is gain-programmed as a function of distance from the station; this programming corrects for beam convergence, thus optimizing the gain through the useful VOR range
  - The course error signal is gain-programmed as a function of airspeed; crosswind update is included, which maintains the aircraft on beam center in the presence of crosswind
  - When the VOR is armed, a white VOR illuminates on the top line of the PFD display with VOR shown in the NAV Source area; when the VOR is captured, the display turns green
  - The following actions disengage the VOR mode: deselect of NAV mode on GMC-7250., APPR or HDG mode selected, go-around selected, change in shown NAV or HDG source, shown heading source invalid, VOR signal invalid over 5 seconds, roll command from trim barrel switch in use with autopilot

- **LOC mode—**Selected by pushing the CDI softkey switch on the DU with the navigation receiver tuned to a localizer frequency; switching and annunciation of the localizer mode is the same as the VOR mode
  - The localizer deviation signal is gain-programmed as a function of radio altitude; if the radio altimeter is invalid or not installed, gain programming is a function of vertical velocity and the time elapsed since beam capture
  - Other valid logic is the same as the VOR mode
  - When armed, a white LOC illuminates on the top line of the PFD display with ILS shown in the NAV Source area; when the localizer has been captured, the display illuminates green
  - The following actions will disengage the LOC mode:
    - Deselect of NAV mode on GMC-7250
    - HDG mode selected
    - Go-around selected
    - Change in shown NAV or HDG source
    - Shown heading source invalid
    - Localizer signal invalid over 5 seconds
    - Roll command from trim barrel switch in use with autopilot
- **FMS mode—**Couples the flight director/ autopilot to a roll steering signal derived for automatic waypoint sequencing of an active flight plan, generated within the FMS
  - When coupled, the flight director/ autopilot commands the airplane to follow an FMS-generated steering signal
  - The FMS mode is engaged by pushing the FMS softkey on the DU, programming the FMS preflight data and flight plan, and selecting NAV on the FGAC
  - When mode is selected, the lateral beam sensor is bypassed and the system goes into FMS
  - The following actions disengage the FMS mode:
    - Deselect NAV mode on GMC-7250
    - HDG mode selected
    - Go-around selected
    - Change in shown NAV or HDG source
    - Shown heading source invalid
    - FMS steering signal invalid
    - Roll command from trim barrel switch in use with autopilot

APPR switch/annunciator—Couples the localizer and glideslope (when tuned to an ILS frequency) or VOR approach (when tuned to a VOR) to both no. 1 and no. 2 flight directors, depending upon the NAV source selection.

The annunciation for the following selected navigational sources are shown above and to the left of the compass card. When this function is selected, the green bar on the top

of the switch comes on. The green bar will go off when the command is deselected or the monitor trips the mode off line.

- **VOR approach mode—**
  - Selected by pushing the APP switch on the mode selector with the navigation receiver tuned to a VOR frequency
  - Mode operation is identical to the VOR mode with the lateral command gains optimized for operation within 10 miles of the VOR station
  - When selected, the VAPP arm annunciation is illuminated on the PFD; the capture logic is the same as described for the VOR mode
  - When the VOR approach is armed, a white VAPP illuminates on the top line of the PFD with VOR shown in the NAV Source area; when the VOR has been captured, this display will turn green
  - The following actions disengage the VAPP mode:
    - Deselect NAV mode on GMC-7250
    - NAV or HDG mode selected
    - Go-around selected
    - Change in NAV or HDG source
    - Shown heading source invalid
    - VOR signal invalid over 5 seconds
    - Roll command from trim barrel switch in use with autopilot
- **ILS approach mode—**
  - Pushing the APPR switch arms both the localizer and glideslope modes when the NAV receiver is tuned to an ILS frequency
  - LOC arm and GS arm annunciations are shown on the PFD; localizer capture logic is the same as described for the LOC mode
  - With the glideslope mode armed, the flight director remains in any previously selected vertical mode; when the vertical beam sensor trip point is reached, the system automatically switches to the glideslope mode, the GS arm annunciation extinguishes, and the GS capture annunciation illuminates
  - At capture, a command is generated to asymptotically approach the glideslope beam; capture can be made from above or below the beam
  - The glideslope deviation is gain-programmed as a function of radio altitude; if the radio altimeter is invalid, gain programming is a function of vertical velocity and the time elapsed since glideslope capture
  - Glideslope capture is interlocked so that the localizer must be captured prior to glideslope capture; if the glideslope receiver is not valid prior to capture point, the system will perform a localizer approach.
  - After capture, if the glideslope receiver becomes invalid, the pitch command bar will bias out of view and the autopilot will hold the pitch attitude existing at the time of the invalid glideslope; the

approach mode will be a non-precision localizer approach

- When the ILS is armed, a white LOC and GS illuminate on the top line of the PFD with ILS shown in the NAV Source area; when the localizer and/or glideslope have been captured, the engaged mode display turns green
- The following actions disengage the LOC and/or GS mode:
  - Deselect APPR mode on GMC-7250
  - NAV or HDG mode selected
  - ALT, VS, FLC, FLCH mode select (affects GS capture only)
  - ASEL capture (affects GS capture only)
  - Go-around selected
  - Change in shown NAV or HDG source
  - Shown heading source invalid
  - Localizer signal invalid over 5 seconds (disconnect LOC and GS)
  - Glideslope signal invalid over 5 seconds (disconnect GS only)
  - ADC invalid

- **Backcourse mode—**
  - This automatic mode operates similar to the localizer mode except that it inverts the deviation input polarity and allows the system to approach the runway from the opposite direction from the localizer mode
  - Automatically selected for localizer approaches when the selected course differs from the heading by more than 105°
  - Input data is the same as the localizer mode with the exception of the middle marker
  - When the localizer is armed, a white LOC illuminates on the top line of the PFD with ILS shown in the NAV Source area; when captured, and the course error at the time of engagement is greater than 105°, a green BC illuminates on the PFD
  - The following actions disengage the BC mode:
    - Deselect APPR mode on GMC-7250
    - NAV or HDG mode selected
    - Go-around selected
    - Change in shown NAV or HDG source
    - Shown heading source invalid
    - Localizer signal invalid over 5 seconds

- **GPS approach mode—**
  - Automatically selected by the GPS when the airplane sequences on to the approach leg
  - Selection of APPR on the flight guidance autopilot controller has no effect on the flight director/autopilot when the NAV source selected on the display controller is FMS
  - When the FMS sequences on approach, a cyan APPR illuminates next to GPS as the NAV source
  - There is no change in the guidance modes as shown on the PFD

SPD, rotary knob with integral pushbutton—The SPD rotary knob controls the vertical speed (VS) digital reference shows, airspeed, and vertical speed reference bugs on both primary flight shows. The airspeed bug and digital reference display are present at all times. The vertical speed bug and digital reference display are present only when VS is selected. With the VS mode selected on the flight director/autopilot, the display readings and bugs correspond to the value that the computer is using to set the desired command reference.

When VS is selected, the airspeed reference and bug freezes at the value indicated at the time of VS engagement. The SPD knob is then used to set the vertical speed reference display and bug.

The airspeed bug is always shown on the airspeed tape. When a Mach reference is selected, the bug corresponds to a selected digital Mach value that is shown above the airspeed tape. When a Mach value is referenced, the digital Mach value above the airspeed tape is referenced to the indicated airspeed digital display on the bottom of the airspeed tape. The Mach reference value is selectable to ±0.01 M.

When engaged in the SPD mode, IAS control is selected automatically if the altitude is less than 30,000 ft. The functions of the SPD rotary knob pushbutton are IAS, MACH, OFF. If the altitude is greater than 30,000 ft, the Mach control is engaged. The function of the pushbutton is then MACH, IAS, OFF. The SPD mode does not automatically switch from MACH to IAS or vice versa when passing through 30,000 ft. The rotary SPD knob is used in this mode to change the desired IAS or MACH command reference and bug.

NOTE

The EFIS speed bug is operational in all FD modes except VS (frozen at the last selected position).

SPD, switch, annunciator—Activation of the SPD function engages the speed hold mode to the number 1 and number 2 flight directors. The SPD function is selected with the FLC button. The speed knob outer ring selects MAN or FMS mode. The manually selected speed reference defaults to 80 kt and then the pilot must change the bug. The SPD knob is used to reset the desired speed reference display and bug. Speed selections beyond V_{MO} or M_{MO} are not allowed; however, there are no limitations for slow speed selections.

The EFIS annunciation for this mode is SPD.

The following actions disengage the manual SPD mode:

- SPD mode on the GMC-7250 is deselected
- ALT, VS, FLC, or FLCH mode is selected
- GS or ASEL is captured
- Go-around is selected
- ADC is invalid
- The pitch command from the trim barrel switch is in use with the autopilot
- Selection of VNAV on the FGAC, the GPS selected as the NAV source, the FMS pitch steering signal is invalid, and the preselect altitude is below the altitude capture band of the aircraft

VS switch/annunciator—Switch activation engages the vertical speed hold mode to the no. 1 and no. 2 flight directors.

When the VS function is selected, the green bar on the top side of the switch illuminates and the vertical speed syncs to the existing vertical speed. The green bar extinguishes when the command is deselected or the monitor trips the mode offline. The SPD rotary knob is used in this mode to reset the desired vertical speed digital reference display and bug.

The vertical speed digital reference display and bug are not displayed (declutter mode) when the VS mode is not selected. The vertical speed mode resolution is 50 ft per minute for rates <1000 ft per minute and 100 ft per minute for rates greater than 1000 ft per minute. The maximum selectable vertical speed is ±6000 ft per minute.

The EFIS annunciation for this mode is VS.

The following actions disengage the VS mode:

- Deselect VS mode on flight guidance autopilot controller
- ALT, FLCH, mode selected
- GS, ASEL capture
- GA selected
- ADC invalid
- Pitch command from trim barrel switch in use with autopilot
- Selection of VNAV on flight guidance autopilot controller, FMS selected as NAV source, FMS pitch steering signal is valid, and the preselect altitude is below the aircraft altitude capture band

FLC, switch, annunciator—Activation of the FLC switch commands the number 1 and number 2 flight directors to give information to change the flight level of the aircraft. The FLC function uses the speed mode control law used in conjunction with the altitude preselect.

When the FLC function is selected, the (green) bar on the right side of the switch illuminates. Push the switch once for the normal climb/descent profile. Selection of the high-speed climb/descent profile is with the GTC. Set the mode to off (the AP reverts to pitch attitude hold) with the switch. The (green) bar goes off when the command is deselected or the monitor trips the mode offline. The climb/descent profile MACH/IAS command references are a function of the altitude preselect function and altitude.

The FLC mode does not let the aircraft fly away from the current altitude unless the altitude preselect is selected to another altitude.

In the FLC mode, the MACH/IAS reference display and bug indicate the commanded speed references as provided by the FGAC.

The EFIS annunciation for this mode is FLC for the normal climb/descend profile and FLCH for the high-speed profile.

The following actions disengage the FLC mode:

- FLC mode on the GC-500 is deselected
- ALT, SPD, or VS mode is selected
- GS or ASEL is captured
- Go-around is selected
- ADC is invalid
- Pitch command from the trim barrel switch is in use with the autopilot
- Selection of VNAV on the FGAC, the selection of FMS as the NAV source, the FMS pitch steering signal is invalid, and the preselect altitude is less than the altitude capture band of the aircraft

VNAV pushbutton switch/annunciator— Switch activation couples the FMS pitch steering commands to the no. 1 and no. 2 flight directors if GPS is selected as the NAV source and the FMS is programmed for a vertical navigation profile.

When the VNV function is selected, the green bar on the right side of the switch illuminates. The green bar extinguishes when the command is deselected or the monitor trips the mode offline. When the VNV mode is armed, a white VNV illuminates on the top line of the PFD. When the vertical navigation engagement criteria have been satisfied, the annunciation turns green.

The EFIS annunciation for this mode is VNAV with GPS in the NAV source shown.

The following actions disengage the VNAV mode:

- Deselect VNV mode on GMC-7250
- ALT, FLCH, VS mode selected
- GS, ASEL capture
- GA selected
- ADC invalid
- FMS pitch steering signal invalid
- Pitch command from trim barrel switch in use with autopilot
- Deselect GPS as NAV source

ALT rotary knob—This knob controls the altitude preselect function for display on the PFD.

The altitude preselect mode features automatic arming if the selected altitude is different than the existing aircraft altitude and the aircraft is flown toward the selected altitude. Selecting another vertical mode other than altitude hold (ALT) does not disconnect the altitude preselect arm mode.

When the preselect mode is armed, a white ASEL annunciation illuminates on the EFIS. When the system captures the selected altitude, a green ASEL illuminates on the EFIS. If the aircraft deviates from the capture profile, an amber ASEL illuminates on the EFIS.

ALT switch/annunciator—Switch activation engages the altitude hold mode of operation to the no. 1 and no. 2 flight directors.

When the ALT function is selected, the green bar on the top of the switch illuminates. The

green bar extinguishes when the command is deselected or the monitor trips the mode offline.

Pushing the ALT switch engages the system in the altitude hold mode (the altitude at the time of the switch push will be the target altitude). If the autopilot is engaged while in the altitude hold mode, the system couples to the altitude error signal and automatically holds altitude through the pitch axis. If the pilot chooses to manually fly the ALT mode (autopilot off) in order to change the altitude target, the pilot must disengage ALT, fly to the new desired altitude, then reengage ALT.

The pilot may also manually change altitude by pushing the touch control steering (TCS) switch, flying to the new altitude, then releasing the TCS switch. Another method is to use the CWTS. By using the CWTS, the ALT mode is canceled and the aircraft will fly the basic attitude mode to the new altitude. Then the ALT mode may be re-engaged to hold a new target altitude.

The EFIS annunciation for this mode is ALT.

The following actions disengage the ALT mode:

- Deselect ALT mode on GMC-7250
- FLCH, VS mode selected
- GS capture
- GA selected
- ADC invalid
- Pitch command from trim barrel switch in use with autopilot
- Selection of VNAV on the flight guidance autopilot controller, FMS selected as NAV source, FMS pitch steering signal is valid, preselect altitude is below the altitude capture band of the aircraft

CRS 2 rotary knob with integral pushbutton—This knob (course symbol on the face) controls the course display on the no. 2 PFD and provides the course to the flight director/autopilot for the VOR and LOC modes.

The roll flight director command is proportional to the course error. The course error signal is gain-programmed as a function of airspeed. Pushing in the CRS knob synchronizes the display to the direct-to course.

FD switch/annunciator (copilot side)— Pushing the FD switch only does not bring the copilot flight director command bars into view. Any subsequent flight director mode selection (pitch or roll axis) causes both the horizontal and vertical command bars to display (the pitch or roll axis not selected engage into attitude hold). When the flight director command bars are in view on both PFDs, the first FD switch pushed removes the command bars from that side only. Pushing the opposite side FD switch disengages all flight director selected modes (AP not engaged).

NOTE

When the CAT II option is exercised, both flight director command bars must be ON to enable the CAT II operation.

The primary function of the FD switches are to bias the FD command bars out-of-view on their respective displays. Exceptions to this functionality are as follows:

- **AP engaged—**The coupled side flight director command bars are always displayed; the uncoupled side flight director may continue to be toggled on/off with the FD switch
- **AP disengaged—**If an FD mode is selected and either of the FD command bars are selected OFF, the command bars on the side selected are biased out-of-view; if the other is selected OFF at this time (both FD command bars are selected OFF), then all FD modes are canceled and no command bars are shown; if no FD modes are selected, no command cue is shown

ATT (not annunciated on the flight guidance autopilot controller)—With the autopilot engaged and no vertical mode selected, the pitch inner-loop maintains pitch attitude. The CWTS and the TCS switch on the coupled side allow the pilot to change the pitch and roll attitude reference (except in ILS glideslope approach). If no outer-loop mode is engaged, the CWTS commands an attitude change proportional to the length of time the switch is pushed or 0.5° per click for pitch and 1° per click for roll.

The TCS switch allows the pilot to manually fly to the desired new attitude with autopilot servos disengaged as long as the button is pushed. When the TCS switch is released, the existing pitch and roll attitudes become the new references (as long as the +20/-10° pitch and ±35° roll limits are not exceeded) and the servos re-engage in pitch and attitude hold.

PIT and ROL illuminate on the PFD when this mode is engaged.

The following actions disengage the PIT attitude hold mode:

- Selection of any vertical FD mode
- GS, ASEL capture

The following actions disengage the ROL attitude hold mode:

- Selection of any lateral FD mode
- Roll command/attitude is <6°, heading hold mode active

WINGS LEVEL, HEADING HOLD (not annunciated on the flight guidance autopilot controller)—With the autopilot engaged and no lateral path mode selected, the roll axis will command wings level and heading hold if the aircraft is within 6° of level. The roll attitude may be changed by employing the CWTS roll command or using the TCS switch on the coupled side (except in ILS LOC approach). The CWTS allows the coupled-side pilot to adjust the bank angle proportional to the length of time the switch is pushed, or 1° per click. The maximum bank angle for this mode is 30°. With the autopilot engaged, the CWTS command cancels any existing lateral mode on the flight guidance autopilot controller, automatically reverting control to the manual CWTS.

ROL illuminates on the PFD when this mode is selected.

If go-around is selected, the FD will command wings level.

The following actions disengage the heading hold mode:

- Selection of any lateral FD mode
- Roll command from trim barrel switch in use with autopilot

OVERSPEED (not annunciated on the flight guidance autopilot controller)—All vertical modes have an overspeed protection function with the exception of:

- Altitude capture (ASEL)
- Altitude hold (ALT)
- Glideslope capture (GS)
- VNAV overspeed protection from FMS
- Autopilot basic pitch (PIT) modes

The autopilot predicts an overspeed condition based on longitudinal acceleration to prevent an overspeed condition from occurring. Overspeed is annunciated by MAX SPD on the PFD (left side of the ADI). During overspeed protection, the flight director/autopilot will control to a speed target to prevent any speed exceedance. Once the overspeed condition is corrected, the system reverts to the mode selected prior to the overspeed condition.

UNDERSPEED (not annunciated on the flight guidance autopilot controller)—The autopilot disconnects when the stick shaker angle-of-attack is reached. Lateral flight director modes remain engaged. Vertical flight director modes default to pitch attitude.

TOUCH CONTROL STEERING (annunciated on the PFD where AP is normally annunciated)—This function is used to manually fly the aircraft while the autopilot is engaged. To use the TCS function, push the TCS button on the control wheel, maneuver the aircraft to the desired condition, and release the TCS button. When TCS button is released, the flight director remains in the mode prior to TCS.

The EFIS annunciation for this mode is TCS instead of the AP annunciation.

GO-AROUND (not annunciated on the flight guidance autopilot controller)—This mode is selected by pushing the throttle-mounted go-around button. This mode disconnects the autopilot and cancels all other vertical and lateral modes except the automatic altitude preselect arm. The flight director provides a wings-level command bar display in the lateral axis and a fixed pitch-up vertical command. The altitude preselect capture is operational, along with the lateral wings-level. When the go-around mode is active, GA illuminates on the PFD.

NOTE

The YD remains engaged during GA.

The following actions disengage the go-around mode:

- Autopilot engagement
- ALT, VS, FLCH mode select
- ASEL capture
- TCS select

FAULT INDICATION

Table 3: Autopilot System – CAS Messages

CAS MESSAGE	LOGIC
AP INOP	Message is posted when any of the following conditions occurs: • Loss of communication to the pitch, roll or yaw servo motors • Loss of roll envelope and pitch envelope protection • There has been a failure in the pitch, roll or yaw servo motors
YD INOP	Message is posted when any of the following conditions occurs: • Communication has been lost to the yaw servo motor. • There has been a failure in the yaw servo motor
AP HOLDING LWD	Message is posted whenever aileron servo loads (LWD): • Have been more than 30-35 in/lbs for greater than 10 seconds. • Annunciation indicates that the control wheel forces may be high when the autopilot is disengaged.
AP HOLDING RWD	Message is posted whenever aileron servo loads (RWD): • Have been more than 30-35 in/lbs for greater than 10 seconds. • Annunciation indicates that the control wheel forces may be high when the autopilot is disengaged.
AP HOLDING NDN	Message is posted whenever the elevator servo loads: • Have not been relieved by the pitch trim system. Message posts in white (STATUS) if the loads (NDN) are not relieved in 15 seconds. • Message posts in amber if the loads are still not relieved fifteen seconds after the white message has been posted, or if the servo torque exceeds 85 in-lbs for five seconds. • Amber message indicates that control wheel forces may be high when the autopilot is disengaged.
AP HOLDING NUP	Message is posted whenever the elevator servo loads: • Have not been relieved by the pitch trim system. Message posts in white (STATUS) if the loads (NUP) are not relieved in 15 seconds. • Message posts in amber if the loads are still not relieved fifteen seconds after the white message has been posted, or if the servo torque exceeds 85 in-lbs for five seconds. • Amber message indicates that control wheel forces may be high when the autopilot is disengaged.

Table 3: Autopilot System – CAS Messages

CAS MESSAGE	LOGIC
AP HOLDING NUP	Message is posted whenever the elevator servo loads: • Have not been relieved by the pitch trim system. Message posts in white (STATUS) if the loads (NUP) are not relieved in 15 seconds. • Message posts in amber if the loads are still not relieved fifteen seconds after the white message has been posted, or if the servo torque exceeds 85 in-lbs for five seconds. • Amber message indicates that control wheel forces may be high when the autopilot is disengaged.
AP HOLDING NDN	Message is posted whenever the integrated avionics computer: • Detects that elevator servo loads (NDN) have not been relieved by the pitch trim system. Message will post in white if the loads are not relieved in 15 seconds. • The white message indicated that the control wheel forces may be high when the autopilot is disengaged.
AP HOLDING NUP	Message is posted whenever the integrated avionics computer: • Detects that elevator servo loads (NUP) have not been relieved by the pitch trim system. Message will post in white if the loads are not relieved in 15 seconds. • The white message indicated that the control wheel forces may be high when the autopilot is disengaged.
WHEEL MSTR	Message is posted any time one of the Control Wheel Master Switches on the Hand Wheels is depressed. • These signals are accessible at 1P604(10) or 2P604(10) for the pilot and the copilot. • The Control Wheel Master switches are in series and produce a single discrete signal (AFCS_DIS in CFG). That signal is normally 28 VDC. • If either Control Wheel Master switch is depressed this signal goes “OPEN”.

This page intentionally left blank

MACH/CONFIGURATION TRIM SYSTEM

(ATA 22-20-00 and 22-25-00)

OVERVIEW

Mach trim provides closed-loop automatic speed stability by controlling the aircraft attitude using the horizontal stabilizer. Relative trim position is determined by a predetermined stabilizer position versus Mach number curve, Mach number (indicated), flap position, and spoiler level position. Mach trim automatically functions at and above 0.78 Mach when the autopilot is disengaged or inoperative. The system includes a monitor to detect malfunctions, disengage the Mach trim system, and alert the pilots through visual means.

Configuration trim interfaces with other aircraft configuration sensors, such as flap position, and spoiler select position, to compensate for pitch movements created when the aircraft configuration is changed. Configuration trim is resynchronized after a manual trim input, or when the aircraft configuration is changed.

The integrated avionics units use manual pitch trim commands to synchronize the Mach/configuration reference position. The primary side of the stabilizer actuator controller processes computer-generated commands. Configuration trim moves the stabilizer a preset amount in conjunction with aircraft configuration, based on a function of spoiler, and flap position inputs relative to airspeed. Mach trim provides variable noseup trim adjustments to counteract the Mach tuck tendency at high altitudes and airspeeds as a function of air data computer outputs.

Configuration trim is only functional when the trim selector switch is in the PRI position and the autopilot is not engaged. The configuration trim functions aid the pilot by providing automatic relief of control column loads via the integrated avionics unit control of horizontal stabilizer position. The configuration trim system control and monitoring functions are provided by software contained in the integrated avionics unit using inputs from spoileron, computer and flap position indication unit. Through these interfaces, the configuration trim provides automatic pitch control for changes in aircraft configuration. Trim commands from either control wheel trim switch have priority over the configuration trim commands.

ASSOCIATED COMPONENTS

The Mach/configuration trim functions reside in the integrated avionics units. The following components are associated with the Mach/ configuration trim system:

- Integrated avionics units (2)
- Trim adapters (2)
- Stabilizer actuator control box
- Stabilizer actuator
- Trim system select switch
- Spoileron computer
- Air data computers (2)
- Flap position indication unit

COMPONENT DESCRIPTION AND OPERATION

Figures 27, 28, and 29

Integrated Avionics Units

Figure 16

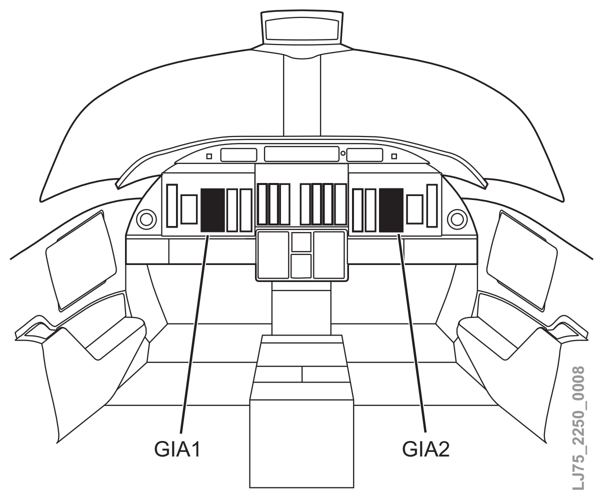


Fig. 16: Integrated Avionics Units

The no. 1 and no. 2 integrated avionics units generate manual, mach, configuration, and auto trim commands, and sends them to the H-stab adapters via two RS 485 buses. The integrated avionics units also monitor both poles of pilot and copilot control wheel master switches (MSWs), and have the ability to stop trim if any mismatch or error exists.

Trim Adapters (2)

Figures 17 and 18

Two trim adapters are installed in the aft fuselage. The trim adapters receive trim commands from the integrated avionics units.

They perform command comparison monitoring on both integrated avionics units commands sent to drive the horizontal stabilizer actuator. Both LRUs interface with the integrated avionics units via RS-485.

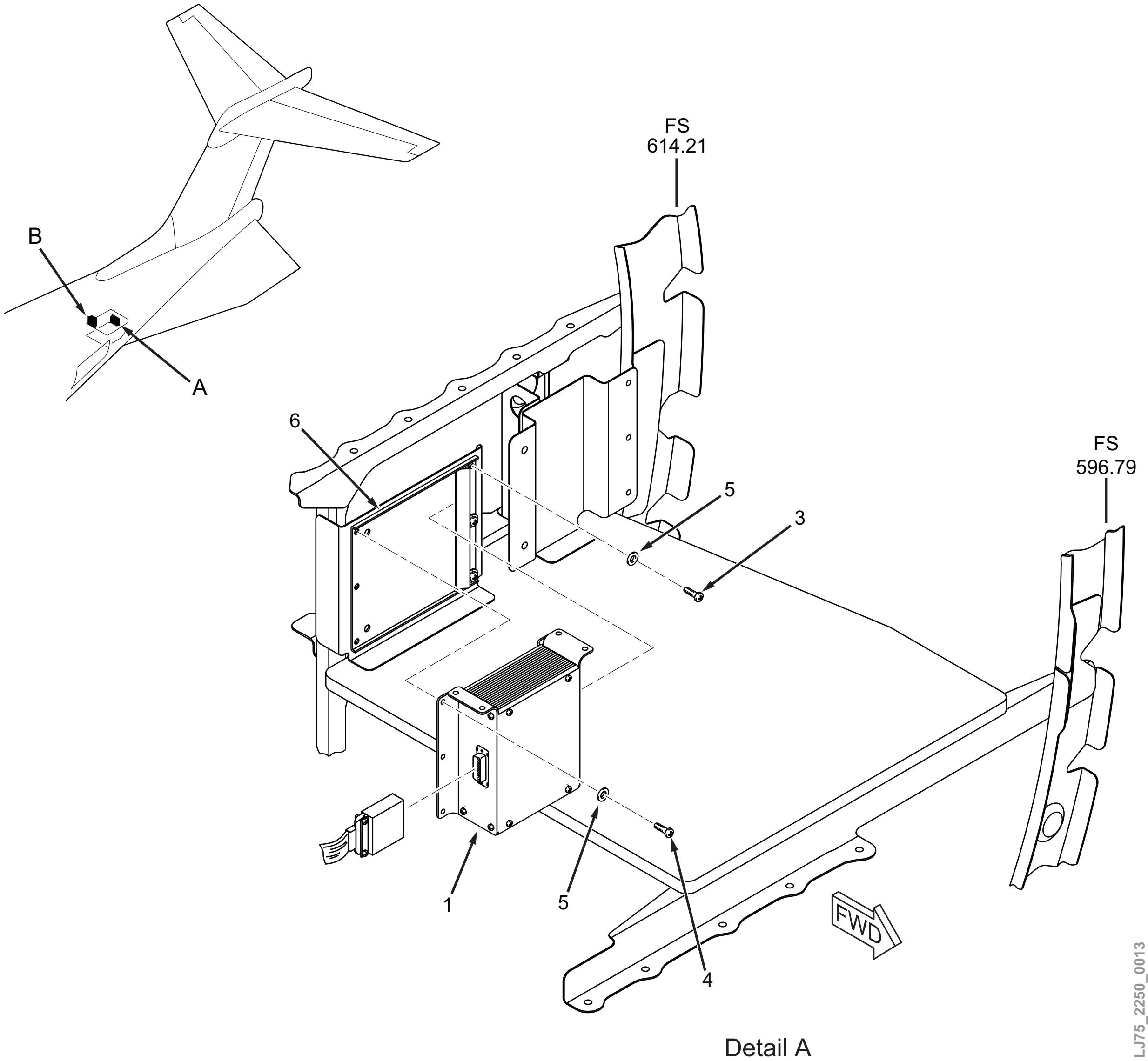
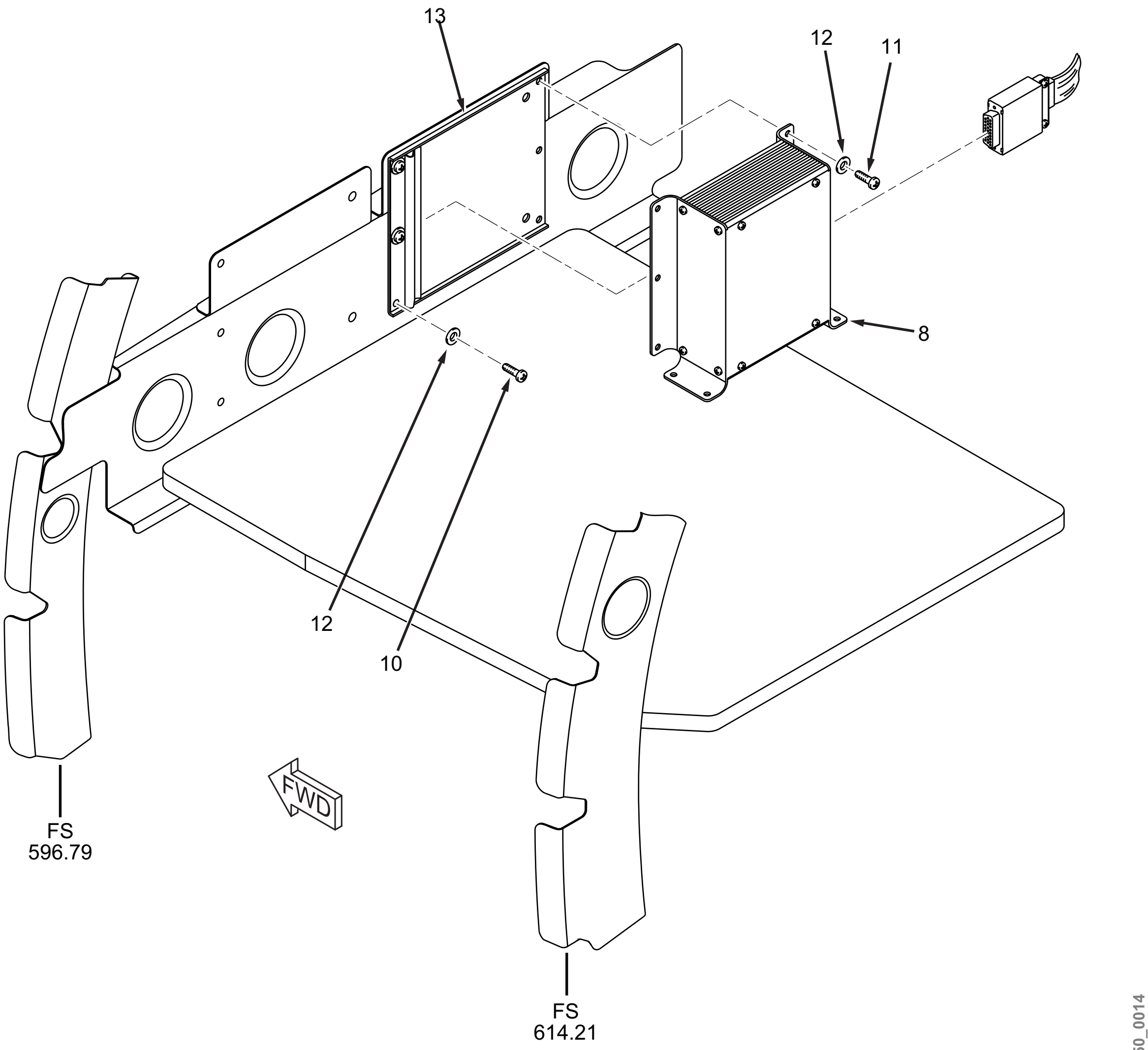


Fig. 17: Trim Adapters (1 of 2)



Detail B

Fig. 18: H-Stab Trim Adapters (2 of 2)

Stabilizer Actuator Control Box

Figure 19

The stabilizer actuator control box is installed in the tailcone section. This LRU controls and monitors the stabilizer. It has two independent sections, primary and secondary. Only the primary section is used for Mach/configuration trim. This control box generates the motor drive commands to their respective sections inside the stabilizer actuator.

To ensure that at least one path of disconnect command is available if a fault is detected, each section also contains independent control wheel master disconnect functions for both the pilot and copilot.

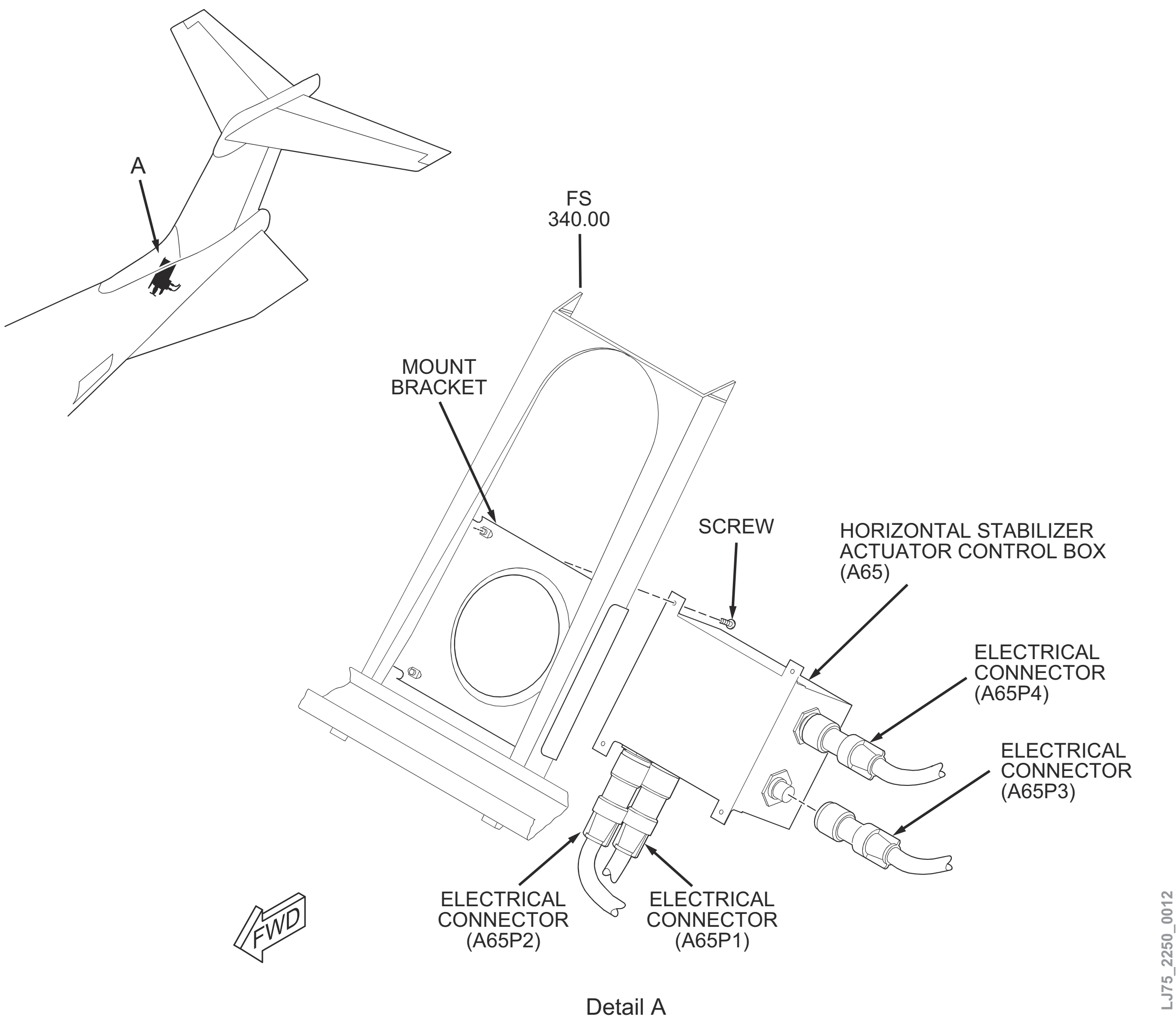


Fig. 19: Stabilizer Actuator Control Box

Stabilizer Actuator Control Box—Primary Section

This section of the stabilizer actuator control box receives the configuration and Mach trim signals from the trim adapter. In this section of the actuator control box, an amplifier converts the signals from the trim adapter into a motor drive output. This motor drive operates only when the TRIM ENABLE signal is valid and no control wheel master inputs are present.

The power and ground for the motor command circuitry is supplied through relays that are controlled by the PRI/OFF/SEC switch located on the pitch trim panel (pedestal). This allows the trim to be positively disconnected by manually setting the PRI/OFF/SEC switch to OFF.

Sensor feedback from the actuator control box primary section includes two position sensors which are “feed through” signals from the stabilizer actuator primary section and one motor tachometer. The position sensors are used for the display system control and monitoring purposes. The tachometer is used by the trim adapter for controlling and monitoring the stabilizer commands. Discrete feedback includes two valid discrete signals, i.e., valid no. 1 and valid no. 2, which initiate CAS messages and display sensor selection. Valid no. 1 initiates an amber CAS message PRI TRIM FAIL and selects which sensor is used for the display system. Valid no. 2 initiates a white CAS message PRI TRIM FAULT.

Stabilizer Actuator

Figure 20

The stabilizer actuator is installed in the vertical stabilizer section of the aircraft. This LRU moves the horizontal stabilizer of the aircraft. It is partitioned into two independent sections, primary and secondary. Each section contains a motor with its tachometer, two position sensors, and the modulation/demodulation circuitry for each of the position sensors. Mach/configuration trim capability is provided via the primary section only.

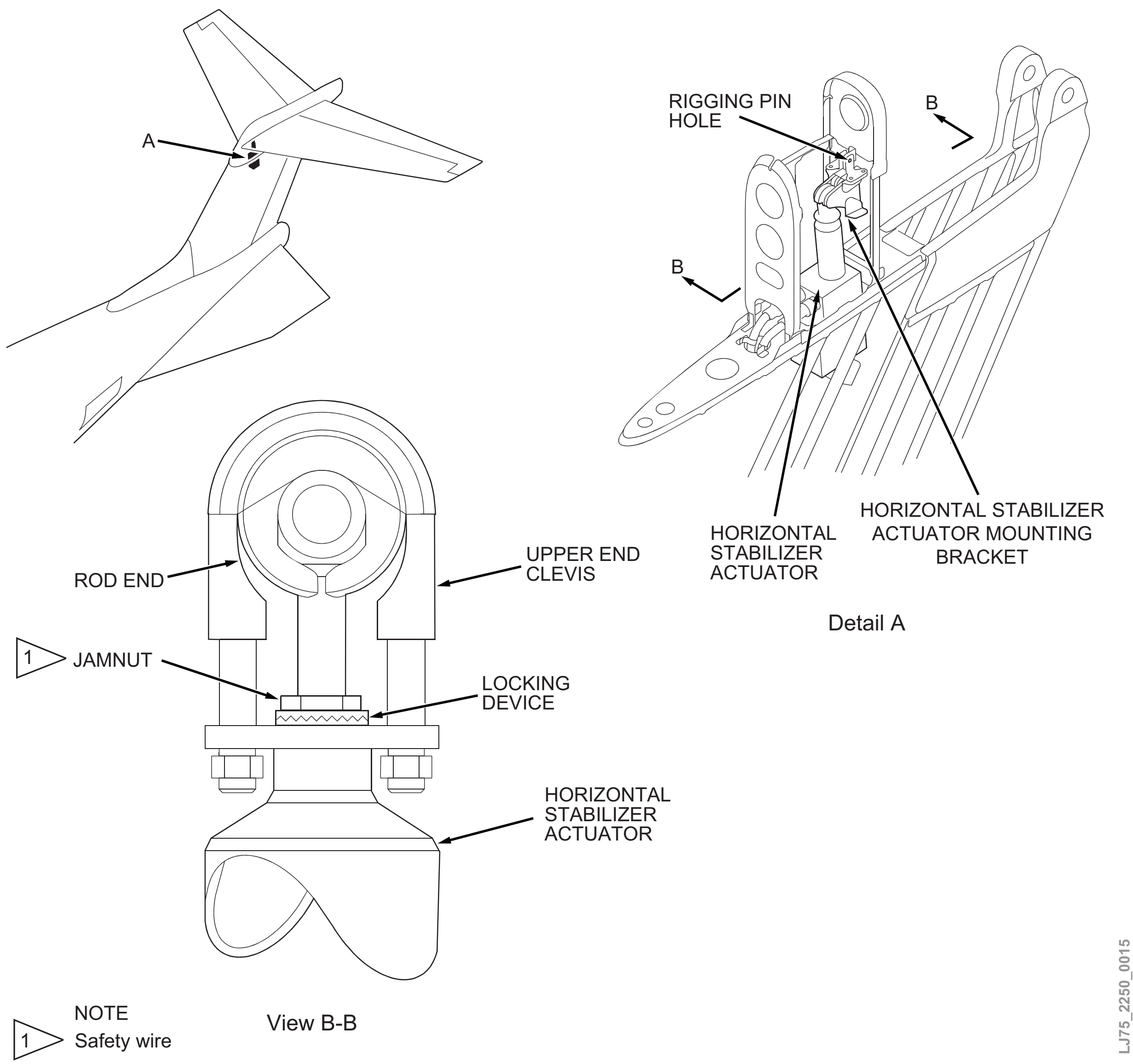


Fig. 20: Stabilizer Actuator

Stabilizer Actuator Primary Section

This section of the stabilizer actuator receives motor drive signals from the primary section of the stabilizer actuator control box. The motors in the stabilizer actuator are brushless DC motors, which enhance reliability.

Trim System Select Switch

Figure 21

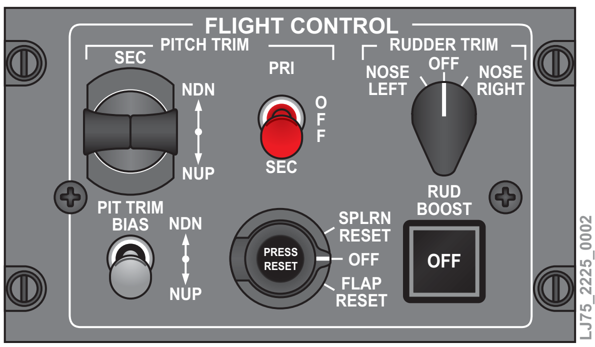


Fig. 21: Trim System Select Switch

The trim system select switch is located on the pitch trim panel (pedestal) and selects the trim system for use. The PRI position enables the primary trim switches in the control wheel, while the SEC position enables the secondary trim switches in the panel.

The selector switch must be positioned to PRI for the Mach/configuration to operate. Selecting OFF or SEC disables all integrated avionics unit 1 trim functions to include the automated Mach/configuration capability. When this switch is set to the OFF position, the power and ground circuits for the motor command functions in the actuator control box are disconnected.

Control Wheel Trim Switch

Figure 22

Used to input primary manual trim inputs, the control wheel trim switch (CWTS) affects Mach/configuration functionality by providing system synchronization. Whenever a CWTS pitch command is input, the Mach/configuration trim references from a different null position.

Both the pilot and copilot control wheel have one of these switches for momentary control of the pitch and roll input trim commands and the autopilot. Each switch is a four-position (LWD, RWD, NOSEDOWN, and NOSEUP) barrel switch with a momentary-action pushbutton switch in the top center of the barrel. By rotating the barrel switch to one of the four positions and depressing the arm switch, it inputs pitch or roll trim command signals.

Control Wheel Master Switch

Figure 22

Mach/configuration trim functions can be interrupted by use of either control wheel master switch (MSW). Both the pilot and copilot control have one of these switches which provide a positive means to disable the trim system. The signals from these switches are provided to both integrated avionics units and both sections of the actuator control box. Both sections of the actuator control box have their own disconnect relay for each control wheel.

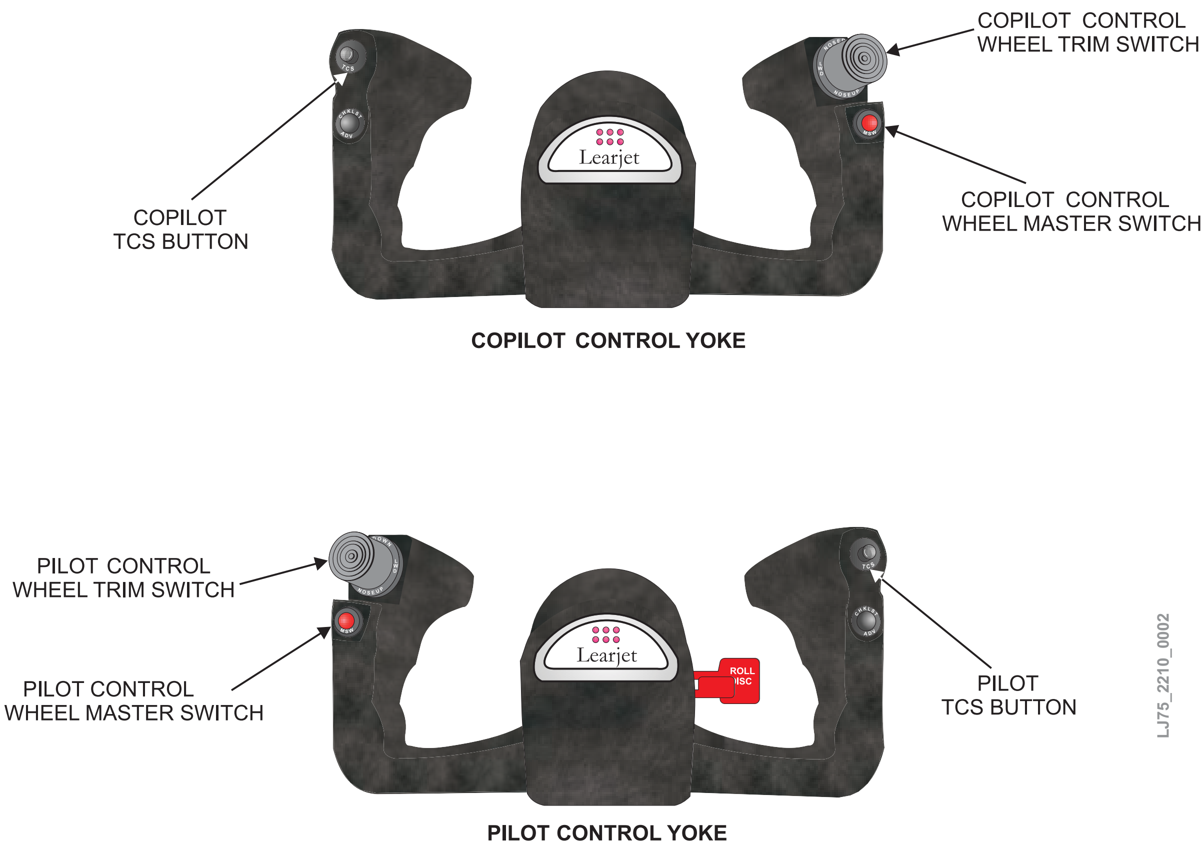


Fig. 22: Control Wheel Trim Switch

Forward Interface Unit

Figure 23

The forward interface unit provides the multiplexing function for the control wheel trim switches, and for the discrete MSW disconnect signals for the stabilizer actuator, integrated avionics units, and spoilerons. To provide redundancy of function, this unit maintains the separation of the pilot and copilot MSW functions.

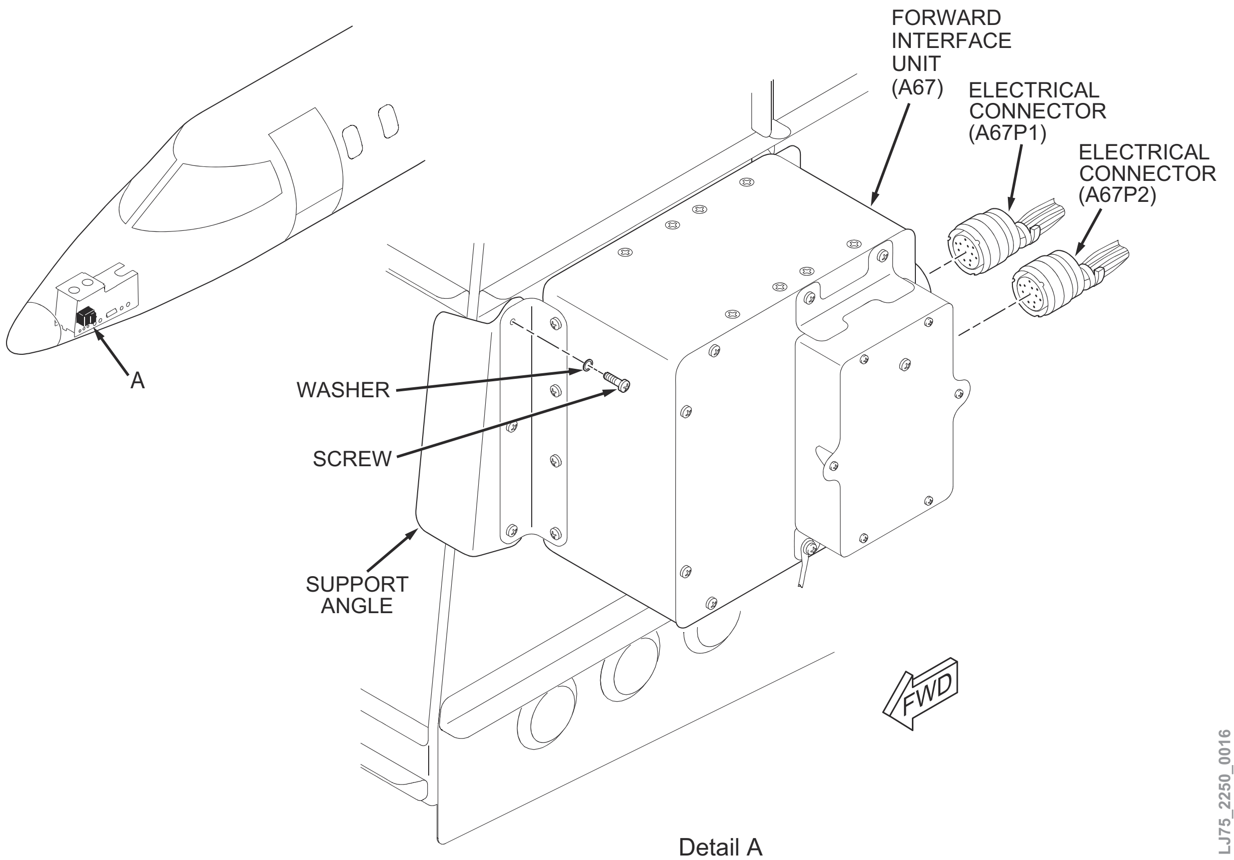


Fig. 23: Forward Interface Unit

Spoileron Computer

Figure 24

The spoileron computer provides the integrated avionics units with the spoiler lever position. The integrated avionics units use the spoiler position to determine the amount of stabilizer deflection necessary for the aircraft's existing condition. There are two separate and independent inputs that feed the integrated avionics units from the spoiler computer for the purpose of monitoring the lever position. If there is a mismatch between these two signals, then the integrated avionics unit flags this and disengages the Mach/configuration trim, if active.

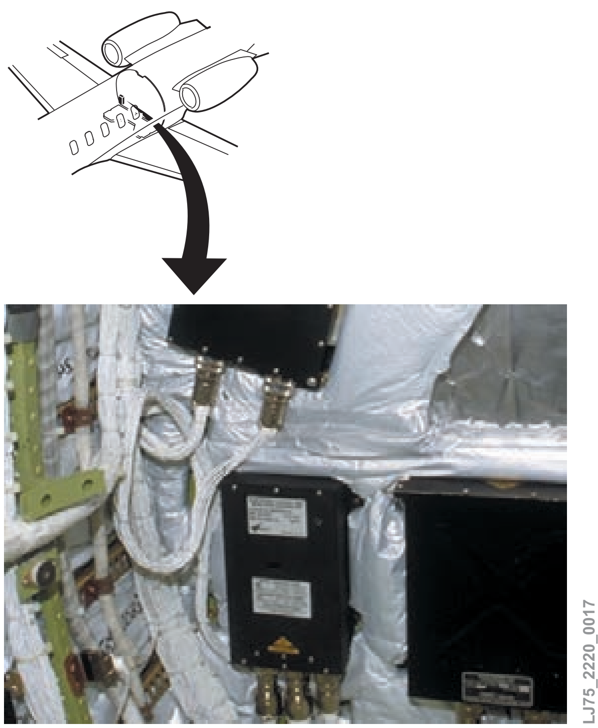


Fig. 24: Spoileron Computer

Air Data Computers

Figure 25

The air data computers provide the integrated avionics units with the air data to compute the Mach number so that it may determine the amount of stabilizer deflection necessary for that speed. The integrated avionics units constantly monitor each other. If there is a disagreement between the air data computers, the integrated avionics units flag this and disengage the Mach/configuration trim, if active.

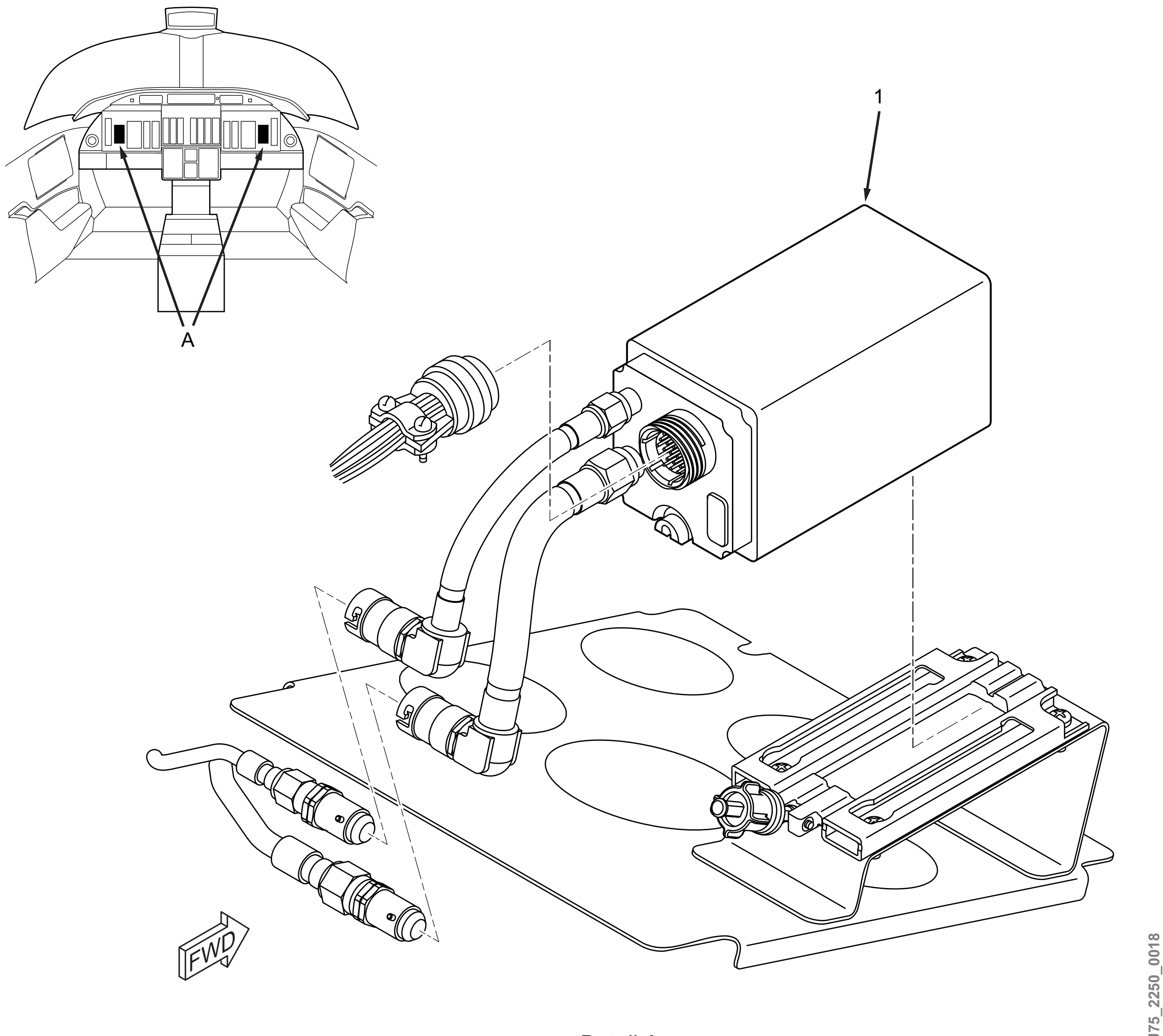


Fig. 25: Air Data Computers

Flap Position Indication Unit

Figure 26

The flap position indication unit provides the integrated avionics units and stabilizer actuator control box with the flap position. The integrated avionics units use the flap position to determine the amount of stabilizer deflection necessary for the aircraft's existing condition. There are two separate and independent inputs that feed each of the integrated avionics units from the flap computer for the purpose of monitoring the lever position. The integrated avionics unit 1 receives a control position of the left and right flap position and the integrated avionics unit 2 receives a monitor position of the left and right flap position.

Essentially, if there is a mismatch between any of these signals, then the integrated avionics unit flags this and disengages the Mach/configuration trim, if active.

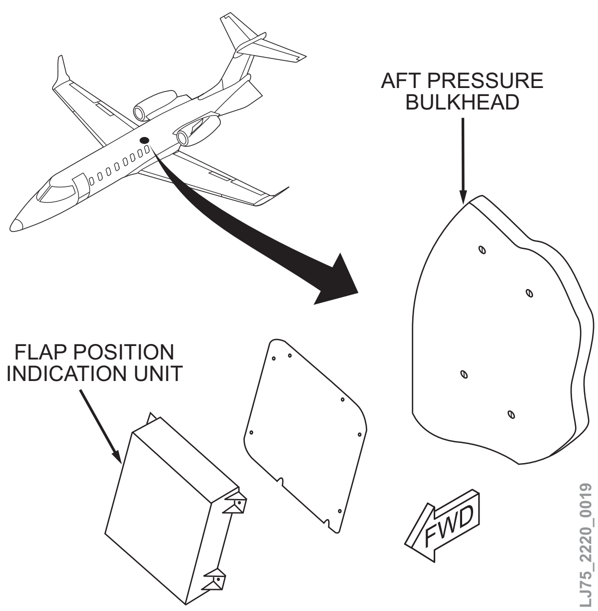


Fig. 26: Flap Position Indication Unit

Configuration Trim System

The configuration trim system provides automatic pitch control for changes in the aircraft configuration. The mode is a function of the configuration monitor system contained in the integrated avionics units. It interfaces with the flap position indication unit, spoileron computer.

When the position of either of these items is changed, the trim adapter energizes the primary trim actuator motor and moves the horizontal stabilizer a preset amount in relation to airspeed to account for the change in pitch attitude. Configuration trim moves the stabilizer at a rate to match the pitch effect caused by the movement of the control surface. This mode is only functional when the trim selector switch is in the PRI position and the autopilot is not engaged. If a fault should occur, the system is disabled.

Mach Trim Function

Mach trim is a fully automatic system installed to increase longitudinal stability and counteract nosedown tendency (Mach tuck) at high Mach numbers. The Mach trim system becomes operational at 0.725 MI and is required above 0.76 MI. The integrated avionics unit performs all computations for Mach trim and signals the primary trim actuator to apply trim as necessary. The integrated avionics units use airspeed information from the air data computers to compute trim requirement.

The pitch trim selector, on the center pedestal, must be in the PRI position for Mach trim to be functional and the autopilot must be disengaged for the Mach trim to become active. If the autopilot is engaged, the H-stab

trim adapter performs pitch trim functions using the secondary trim actuator if the integrated avionics unit 1 Mach trim is in a passive mode.

Mach trim automatically becomes active at 0.725 Mach when the autopilot is disengaged or inoperative. Noseup trim is applied as Mach increases and nosedown as Mach decreases. Mach trim is interrupted whenever manual trim is activated. The system resynchronizes about the new horizontal stabilizer position when manual trim is released.

If the pitch trim system is selected OFF or SEC a white MACH TRIM FAIL message will be displayed on the CAS. If the integrated avionics unit detects a fault within the Mach trim system, a MACH TRIM FAIL message is posted on the EICAS display. The message is white if the airspeed is below 0.76 MI and changes to amber if the airspeed is at or above 0.76 MI. When the MACH TRIM FAIL message is posted, the overspeed cue on the airspeed indicator adjusts to indicate a Mach limit of 0.76 MI.

SYSTEM MONITORS

The Mach/configuration trim system makes extensive use of continuous monitoring to protect system integrity. Several monitoring schemes provide protection against a data or equipment error, which could cause an uncontrollable reaction or error in the operation of the Mach/configuration trim system. On sensing incorrect or erroneous data, the appropriate monitor initiates a disconnect or warning as appropriate.

A list of the monitors follows:

- Integrated avionics unit monitors
- Primary trim position comparison monitor
- Flap input comparison monitor
- Spoiler lever comparison monitor
- Mach/configuration trim runaway monitor
- Mach/configuration trim inoperative monitor
- Stabilizer actuator monitor

FAULT INDICATION

Table 4

The Mach/configuration trim system continuously monitors itself and its inputs to determine satisfactory operation. Appropriate caution and warning information is provided to the crew in the event of a Mach/configuration trim system malfunction.

Table 4: Mach Trim System – CAS Messages

CAS MESSAGE	LOGIC
MACH TRIM FAIL	An amber caution message is posted if: • Indicated Mach airspeed from either ADC is greater than 0.76M, and • Pitch trim is OFF, or secondary pitch trim is ON, or the PRIMARY TRIM FAIL discrete is Open/Fail, or PRI TRIM FAULT discrete=1P605(51) or 2P605(51) is Open/Fail, or the Mach trim system is otherwise failed • A two-second delay shall occur before posting and removal of this message
MACH TRIM FAIL	A white status message is posted if: • Indicated Mach airspeed from either ADC is less than or equal to 0.76M, and • Pitch trim is OFF, or secondary pitch trim is ON, or the PRIMARY TRIM FAIL discrete is Open=Fail, or PRI TRIM FAULT discrete=1P605(51) or 2P605(51) is Open=Fail, or the Mach trim system is otherwise failed

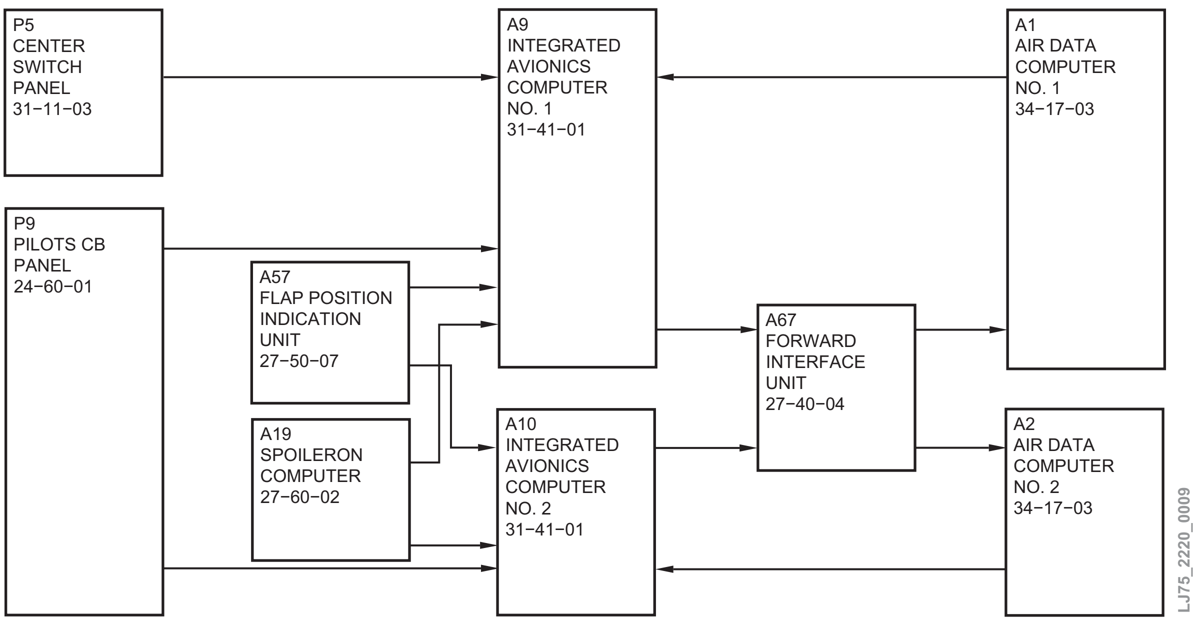


Fig. 27: Mach Trim System Block Diagram

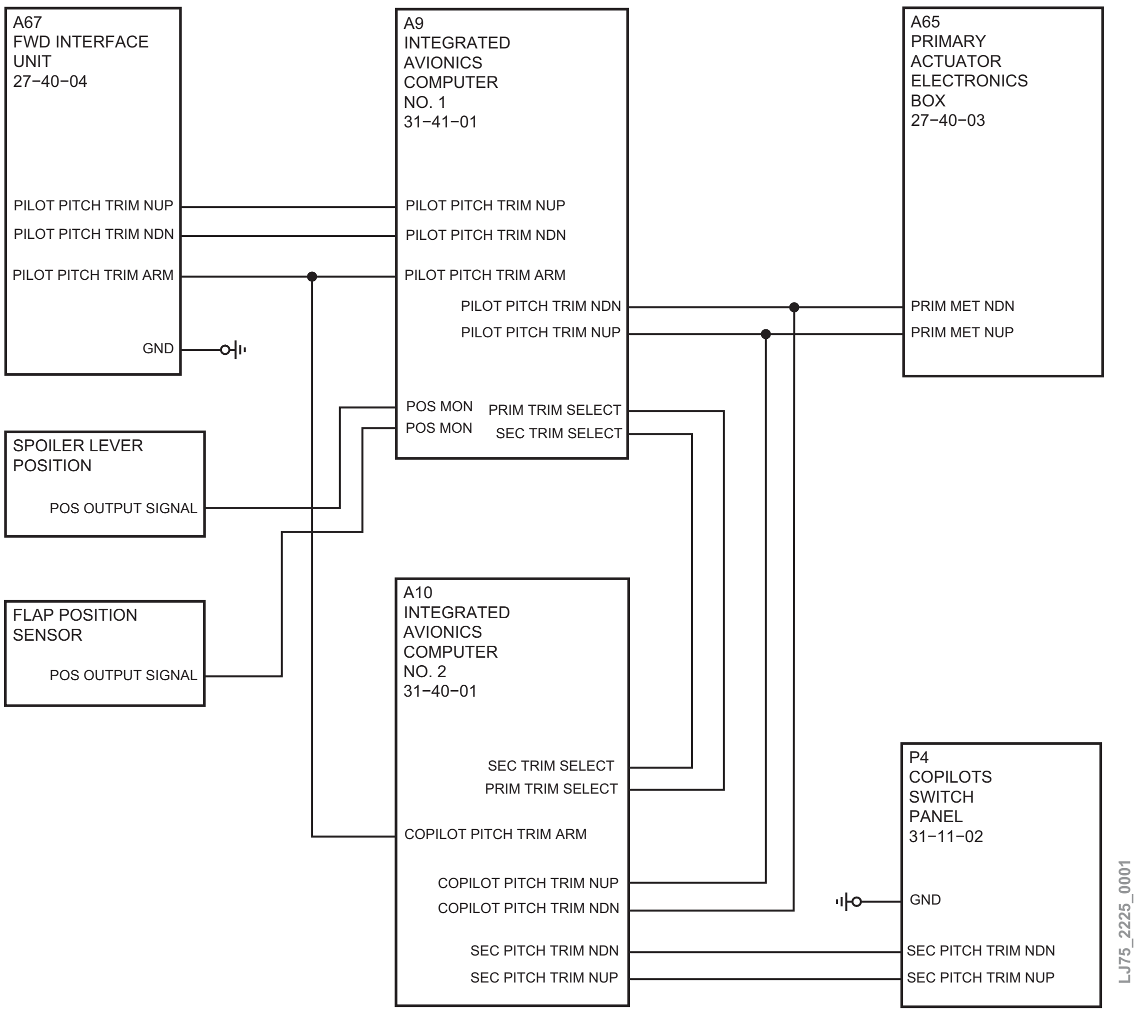


Fig. 28: Configuration Trim System Block Diagram (1 of 2)

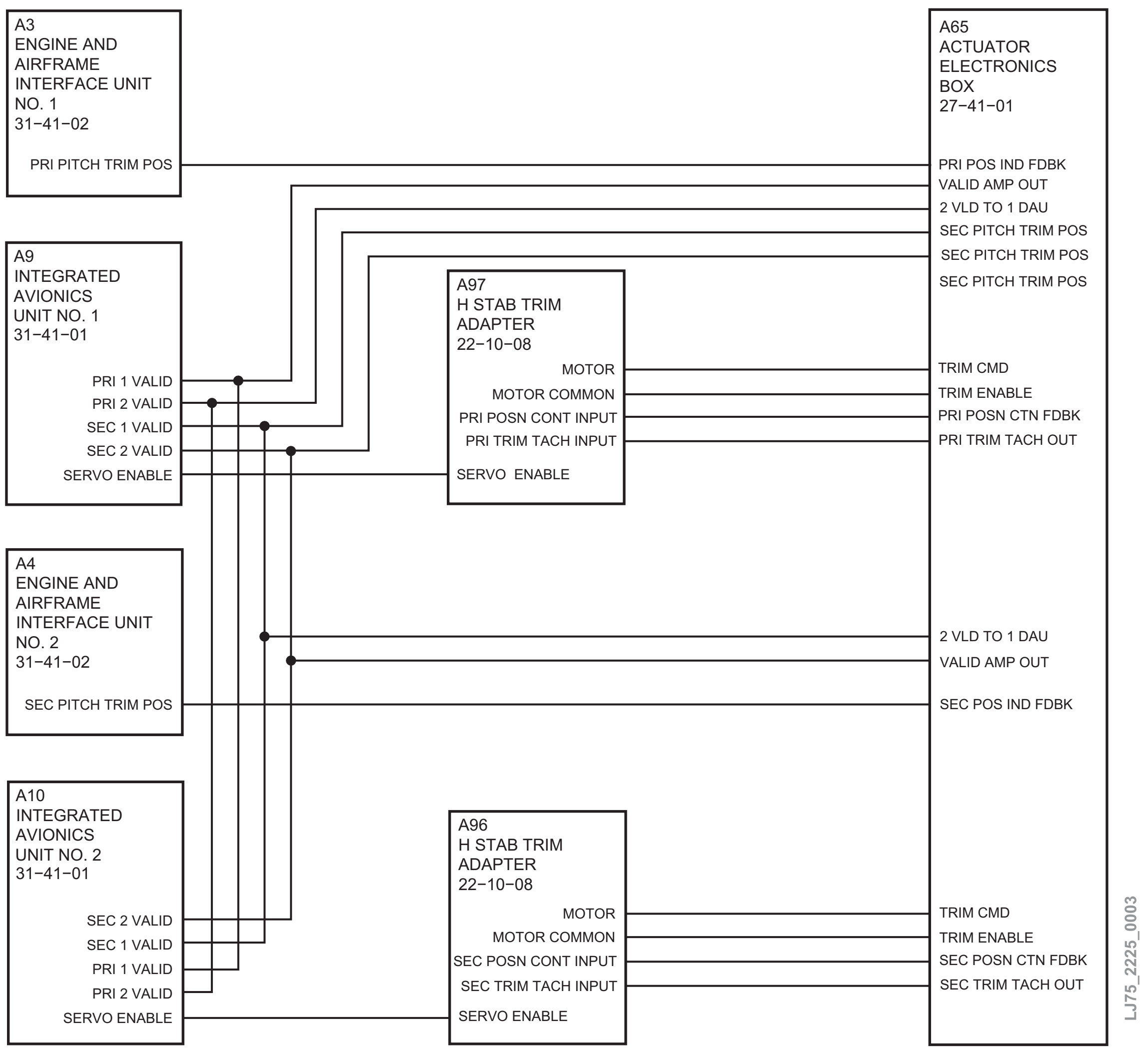


Fig. 29: Configuration Trim System Block Diagram (2 of 2)

RUDDER BOOST SYSTEM

(ATA 22-50-00)

OVERVIEW

The rudder boost system helps the crew when very high rudder pedal force is necessary to keep directional control of the aircraft.

COMPONENTS

The rudder boost system contains the following items:

- Integrated avionics unit
- Rudder boost switch/indicator
- Yaw servo
- Rudder pedal force sensors (2)
- Forward interface unit
- Yaw force interface box

COMPONENT DESCRIPTION AND OPERATION

Integrated Avionics Units

Figure 30

The no. 1 integrated avionics unit has the rudder boost inputs as follows:

- Touch control steering 1
- Rudder boost ARM 1
- Go around 1

The no. 2 integrated avionics unit integrated avionics unit has the rudder boost inputs as follows:

- Touch control steering 2
- Rudder boost ARM 2
- Go around 2

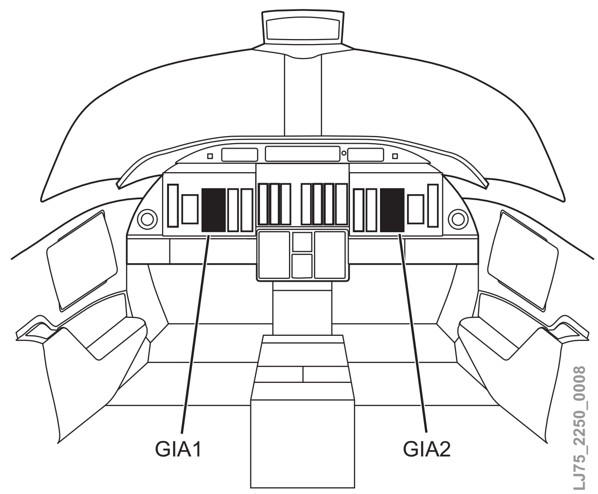


Fig. 30: Integrated Avionics Units

The integrated avionics units calculate the rudder boost and yaw damper outputs necessary to operate these systems. The monitor processor monitors these commands. When a fault is sensed or there is disparity from one rudder force sensor to the other, the monitor processor disconnects from the integrated avionics unit.

Rudder Boost Switch/Indicator

Figure 31

The rudder boost switch is located in the pedestal on the FLIGHT CONTROL panel. The rudder boost system is automatically activated when all the following conditions exist:

- Flaps are >3° or the aircraft is on the ground
- System does not detect a fault
- System is not selected OFF
- Sum of pilot and/or copilot forces is >50 lb

The automatic rudder boost system may be turned off by selecting OFF with the RUD BOOST switch located on the FLIGHT CONTROL panel of the pedestal.

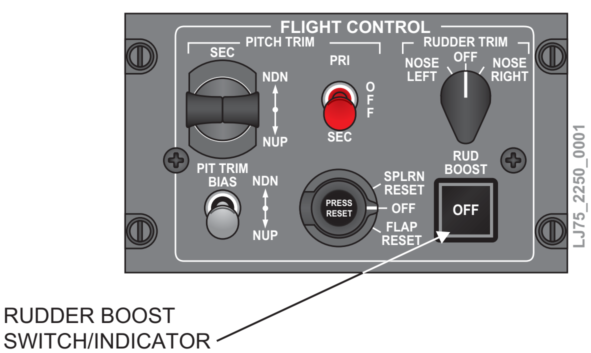


Fig. 31: Rudder Boost Switch/Indicator

Yaw Servo

Figure 32

The yaw servo can position the rudder under the control of the yaw damper or rudder boost systems. The yaw servo is a bidirectional torque motor. It incorporates an electrical clutch that engages only when the yaw damper is engaged or when the rudder boost is commanding rudder assistance. When the clutch is engaged, the servo is connected via a closed-loop cable to the aft rudder sector.

In the event of a malfunction, the yaw servo clutch can be disengaged by pressing and holding either control wheel master switch (MSW). Depressing the MSW disconnects the yaw damper.

Rudder boost is disabled as long as the MSW is held depressed. If the malfunction is isolated to the rudder boost, the RUD BOOST switch/indicator on the center pedestal can be selected to OFF.

The yaw servo receives electrical power through the AFCS SERVOS circuit breaker located in the FLIGHT group of circuit breakers on the pilot circuit breaker panel.

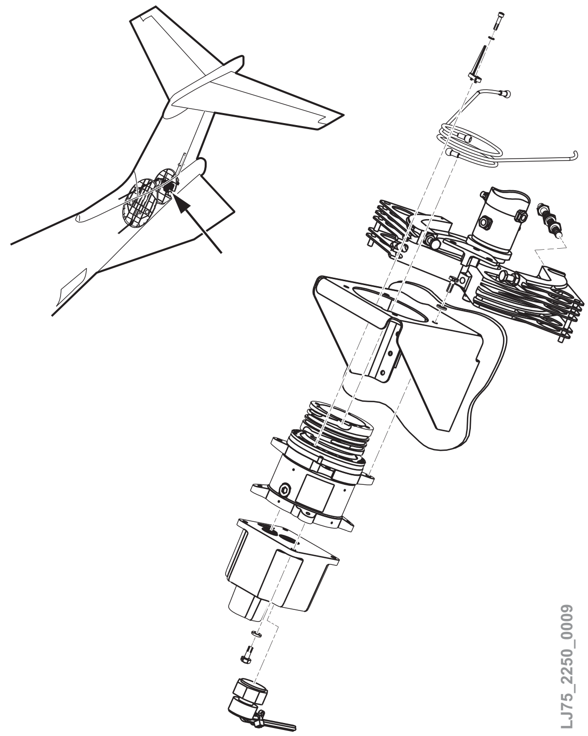


Fig. 32: Autopilot Yaw Servo

Rudder Pedal Force Sensor

Figure 33

The rudder pedal force sensors are located at FS161 under the pilot and copilot floorboards. The force sensor is the cylindrical device located at the end of the T-lever and is connected to a pushrod, which attaches to the forward sector.

Dual redundant strain gauge-force sensors measure rudder pedal force. Force sensor outputs supply the data inputs to the integrated avionics units and the monitor processor for health and status display data. Force sensors are installed on the flight crew rudder assemblies.

Force sensors also apply an output to the yaw force-interface box. The yaw force-interface box increases the signal level and applies it to the rudder boost and nosewheel steering systems (refer to 32-50-00).

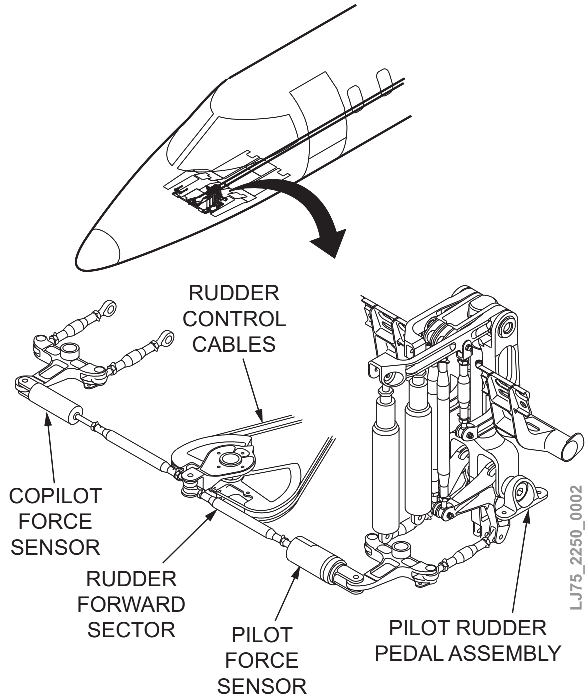


Fig. 33: Rudder Boost Force Sensors

Forward Interface Unit

Figure 34

The forward interface unit is located in the nose avionics area. The manual pitch trim, Mach/configuration trim, autopilot systems, nosewheel steering, and the damper also use the forward interface unit.

The rudder boost function interfaces with the integrated avionics unit for the rudder boost arm switch when it receives a YFIB VALID signal from the yaw force interface box.

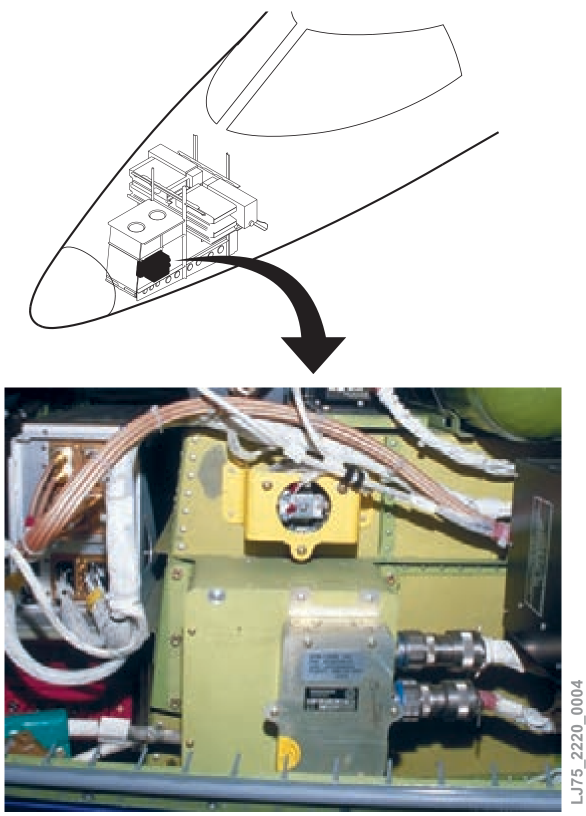


Fig. 34: Forward Interface Unit

Yaw Force Interface Box

Figure 35

The yaw force interface box (YFIB) is located at FS150 on the forward pressure bulkhead forward of the instrument panel. The YFIB provides signal conditioning of the rudder pedal force sensor outputs for the rudder boost function. It provides each channel of the pilot/copilot force link sensors with 5-VDC excitation voltage.

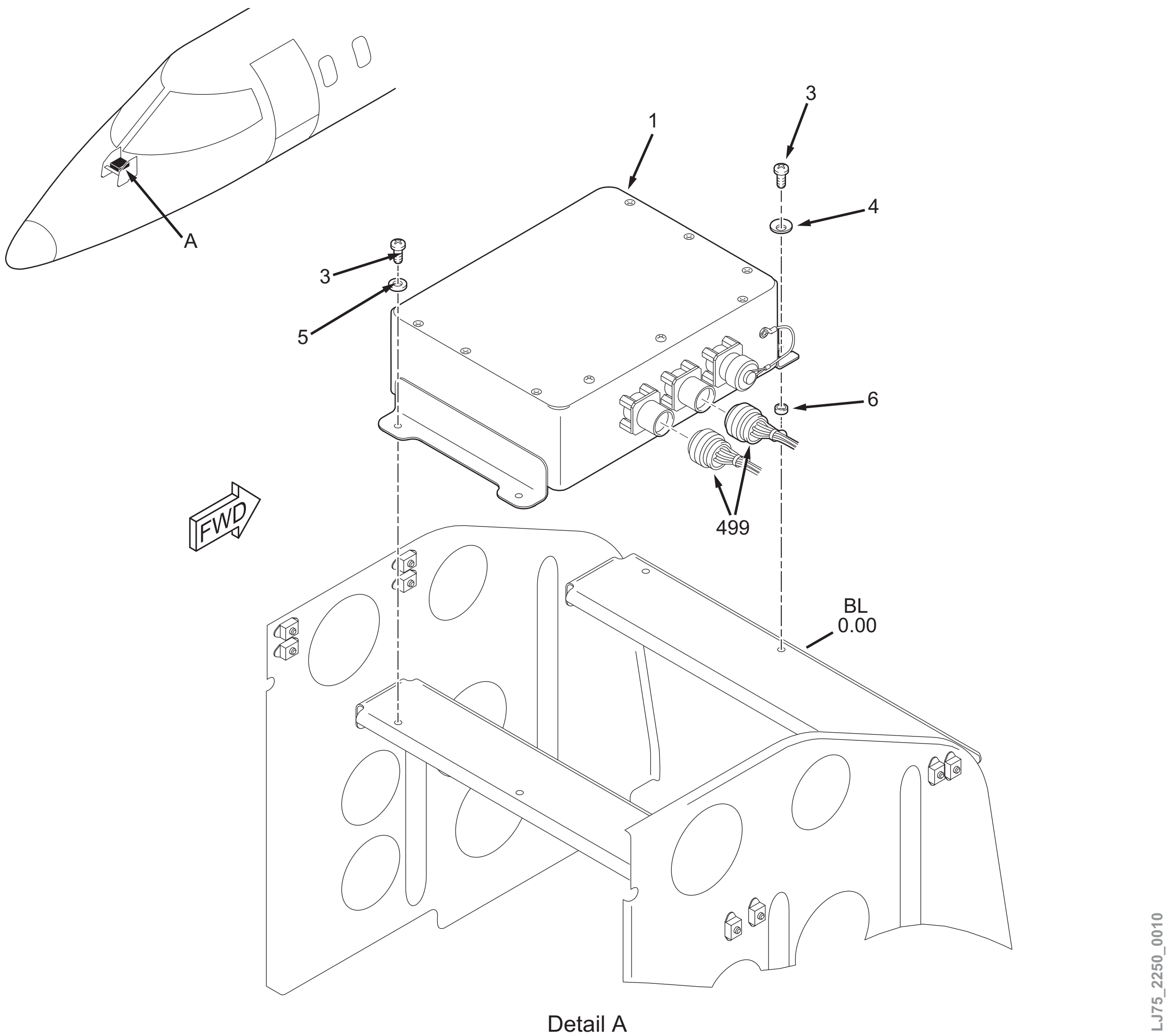


Fig. 35: Yaw Force Interface Box

OPERATION

The rudder boost system applies torque to the yaw capstan when the flaps are set to more than three degrees, the RUD BOOST switch OFF annunciator is off, and the RUD BOOST INOP annunciators on the EICAS display are off.

The integrated avionics units (IAUs) collect airspeed from the air data computers and heading from the attitude heading reference units to generate a torque command that is sent to the yaw servo. The yaw servo applies force to the rudder pedal, based on the received command. The yaw servo also monitors the command from each IAU to make sure that they are in agreement within a specific tolerance. The display units are used to indicate the status of the rudder boost system to the crew.

The IAUs calculate the rudder boost and yaw damper outputs that are necessary to operate these systems. The monitor processor monitors these commands. When a fault is sensed, or there is disparity from one rudder force sensor to the other, the monitor processor disconnects from the IAU. The IAUs command the DC-servo motor to apply torque to the rudder shaft automatically.

The rudder boost connects automatically when flaps are more than three degrees, there are no RUD BOOST INOP annunciators shown on the EFIS and EICAS displays, and the sum of the control force from the pilot and copilot rudder pedals is more than 50 lb (22.7 kg). (Refer to 31-51-00 and 31-60-00.) To disengage the rudder boost system, put the RUD BOOST switch in the OFF position. The RUD BOOST switch OFF annunciator comes on (at the aft pedestal).

Dual redundant strain gauge-force sensors measure the rudder pedal force. Force sensor outputs supply the data inputs to the IAUs and the monitor processor for health and status display data. Force sensors are installed on the pilot and copilot rudder assemblies.

Force sensors also apply an output to the yaw force interface box. The yaw force interface box increases the signal level and applies it to the rudder boost and nosewheel steering systems. (Refer to 32-50-00.)

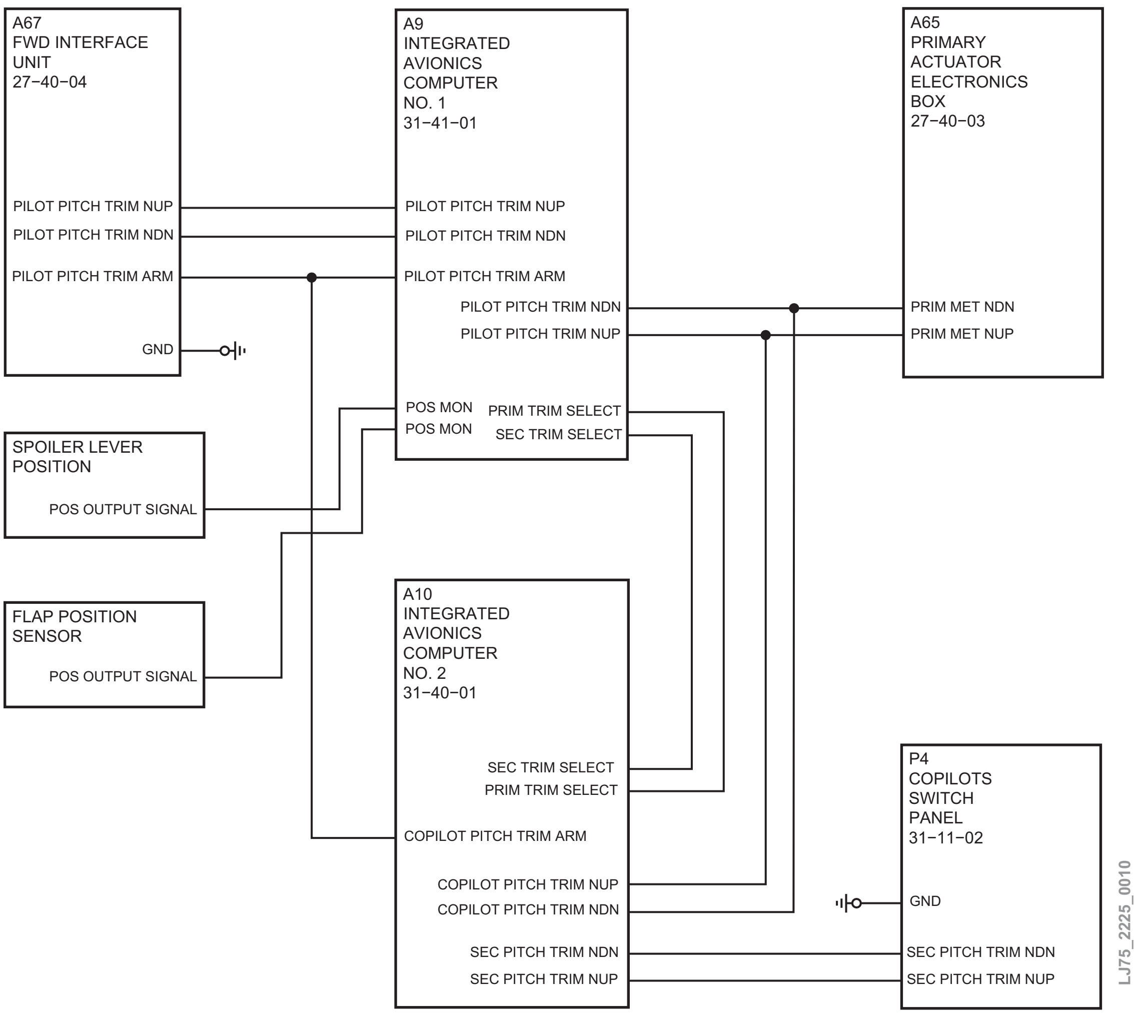


Fig. 36: Rudder Boost System Block Diagram (1 of 2)

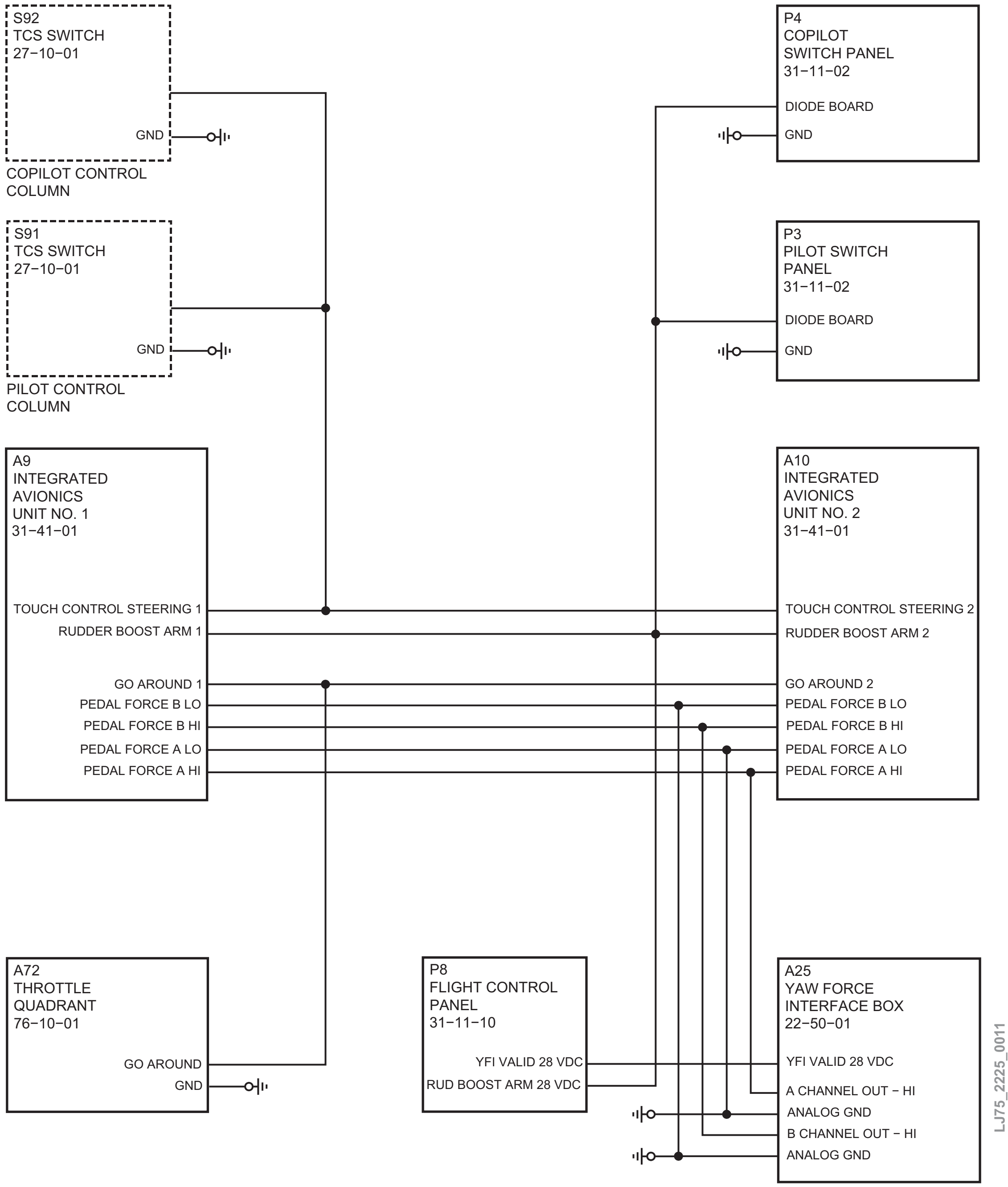


Fig. 37: Rudder Boost System Block Diagram (2 of 2)

FAULT INDICATION

Table 5: Rudder Boost System—CAS Messages

CAS MESSAGE	LOGIC
RUDDER BOOST INOP	An amber caution message is posted when: • Rudder boost arm is true, and • Failure/fault occurred in the rudder boost or yaw interface system • Loss of altitude or airspeed information from either ADC
RUDDER BOOST INOP	A white status message is posted when: • RUD BOOST switch is set to OFF

TABLE OF CONTENTS

COMMUNICATIONS
(ATA 23-00-00)
INTRODUCTION 1

VHF COMMUNICATION SYSTEM
(ATA 23-10-00)
OVERVIEW 3
COMPONENTS 3
ASSOCIATED COMPONENTS 4
COMPONENT DESCRIPTION AND OPERATION 4
VHF COM Antennas 4
Integrated Avionics Units 5
Audio Processor Units 7
Touch Controllers 7
Remote Controllers 8
Display Units 8
Emergency Communication Switch 8
Clearance Delivery Switch 8
OPTIONAL SYSTEMS 8
VHF Datalink CPDLC Radio 8
VHF Datalink and COM 3 Antenna 9
CONTROLS AND INDICATIONS 9
SYSTEM OPERATION 9
Optional COM 3 10
COM Controls 10
COM Frequencies GTC Setup 11
EMER COM Mode 14
Audio Integrating System Interface 14
Power 14
FAULT INDICATION 18

HF COMMUNICATION SYSTEM
(ATA 23-12-00)
OVERVIEW 21
COMPONENTS 21
ASSOCIATED COMPONENTS 21

COMPONENT DESCRIPTION AND OPERATION 21
Power Amplifier 21
Antenna Coupler 21
HF Receiver/Exciter 21
Antenna and Coax Feed-Through Insulator 22
Antenna Fuse Block 22
Remote Circuit Breakers 22
ASSOCIATED COMPONENTS 26
Touch Controllers 26
Serial Data Concentrator Units 26
SYSTEM OPERATION 27

IRIDIUM SATCOM SYSTEM
(ATA 23-15-00)
OVERVIEW 35
COMPONENTS 35
ASSOCIATED COMPONENTS 35
COMPONENT DESCRIPTION 35
SATCOM Transceiver 35
SATCOM Antenna 36
Maintenance Data Recorder and Wireless Datalink Unit 36
SYSTEM OPERATION 37
FAULT INDICATIONS 40

SELCAL SYSTEM
(ATA 23-20-00)
OVERVIEW 41
ASSOCIATED COMPONENTS 41
COMPONENT DESCRIPTIONS 41
Audio Processor Units 41
GTC Touch Controllers 42
SYSTEM OPERATION CONTROLS AND INDICATIONS 42
SELCAL Code Setup 42
SELCAL Signal Reception 42
SYSTEM INTERFACES 43

CONTROLLER-PILOT DATALINK COMMUNICATION
(ATA 23-25-00)
OVERVIEW 45
COMPONENTS 47
ASSOCIATED COMPONENTS 47

COMPONENTS DESCRIPTION ... 47
VDL Datalink Radio Unit ... 47
VHF Datalink and COM 3 Antenna ... 48
ASSOCIATED COMPONENTS DESCRIPTION ... 48
GTC Touch Controllers ... 48
Display Units ... 48
Integrated Avionics Units ... 48
Serial Data Concentrator Units ... 48
#1 Audio Processor Units ... 48
CPDLC SYSTEM CONTROLS AND DISPLAYS ... 49
Messages ... 49
CPDLC Status and Logon ... 49
CPDLC Messages Tab ... 50
New Message Creation ... 50
Message Response Pages ... 50
Supported CPDLC Messages ... 51
ATC Microphone Check ... 52
Cockpit Voice Recorder Interface ... 52
SYSTEM OPERATION ... 52

PASSENGER ADDRESS SYSTEM
(ATA 23-30-00)
OVERVIEW ... 55
ASSOCIATED COMPONENTS ... 55
COMPONENT DESCRIPTION AND OPERATION ... 55
Passenger Speakers ... 55
Touch Controller (GTC) ... 56
NO SMKG/BELTS Switch ... 56
Audio Processor Units ... 56
Cabin Management System ... 56
SYSTEM OPERATION ... 57

AUDIO INTEGRATING SYSTEM
(ATA 23-50-00)
OVERVIEW ... 59
COMPONENTS ... 59
ASSOCIATED COMPONENTS ... 59
COMPONENT DESCRIPTION AND OPERATION ... 59
Audio Processors ... 59
Integrated Avionics Units ... 60
Cockpit Speakers ... 60

GTC Touch Controllers 60
SYSTEM OPERATION 60
Power 61
FAULT INDICATIONS 62

STATIC DISCHARGING SYSTEM
(ATA 23-60-00)
OVERVIEW 65
COMPONENTS 65
COMPONENT DESCRIPTION AND OPERATION 65
Static Dischargers 65
SYSTEM OPERATION 65

COCKPIT VOICE RECORDER SYSTEM
(ATA 23-70-00)
OVERVIEW 67
COMPONENTS 67
Associated Components 67
COMPONENT DESCRIPTION AND OPERATION 69
Cockpit Voice Recorder 69
Control Panel 69
Area Microphone 69
CVR Preamplifier 70
Inertia Switch 70
Audio Processor Units 70
SYSTEM OPERATION 71
Electrical Power Application 71
Record, Test, and Status Monitor 71
Push-To-Erase Function 71
Loss or Removal of Electrical Power 71
Cessation of Recording 71
FAULT INDICATIONS 72

COMMUNICATIONS

(ATA 23-00-00)

INTRODUCTION

Figure 1

The integrated communications system on the Learjet 70/75 aircraft utilizes the G5000 system.

The communication system uses two identical VHF radios for voice communication (VHF1 and VHF2) and an optional VHF radio with different architecture for voice and data communication (VHF3).

VHF1 and VHF2 radios are housed in the respective integrated avionics units and are controlled by either the touch controllers (GTC) or the remote controllers. Each GTC provides control to either radio and the optional third VHF radio during normal operation.

In the event of a GTC failure, control for all radios will be provided by the remaining GTC or either remote controller. The radio will revert to the emergency 121.50 MHz frequency when the EMER COM switch is pressed or automatically when all tuning control is lost.

The active frequency for each of these radios is always displayed in both PFD windows and on the GTCs. Standby frequencies for each radio are displayed on the GTCs.

All three VHF radios have automatic or manual squelch control. A white SQ is displayed next to the COM frequency display when auto squelch is disabled in both display areas. All three radios provide tuning to channels spaced by 8.33 kHz or 25 kHz.

The GTCs also provide control for each radio volume, as well as system volume.

Auxiliary optional communication systems include a single or dual HF system for long-range communications. A SELCAL alerting system is selectable as an option.

This chapter includes the following sections:

- Communications ATA 23-00-00
- VHF Communication System ATA 23-10-00
- HF Communication System ATA 23-12-00
- Iridium SATCOM System ATA 23-15-00
- SELCAL System ATA 23-20-00
- Controller—Pilot Datalink Communication ATA 23-25-00
- Passenger Address System ATA 23-30-00
- Audio Integrating System ATA 23-50-00
- Static Discharging System ATA 23-60-00
- Cockpit Voice Recorder ATA 23-70-00

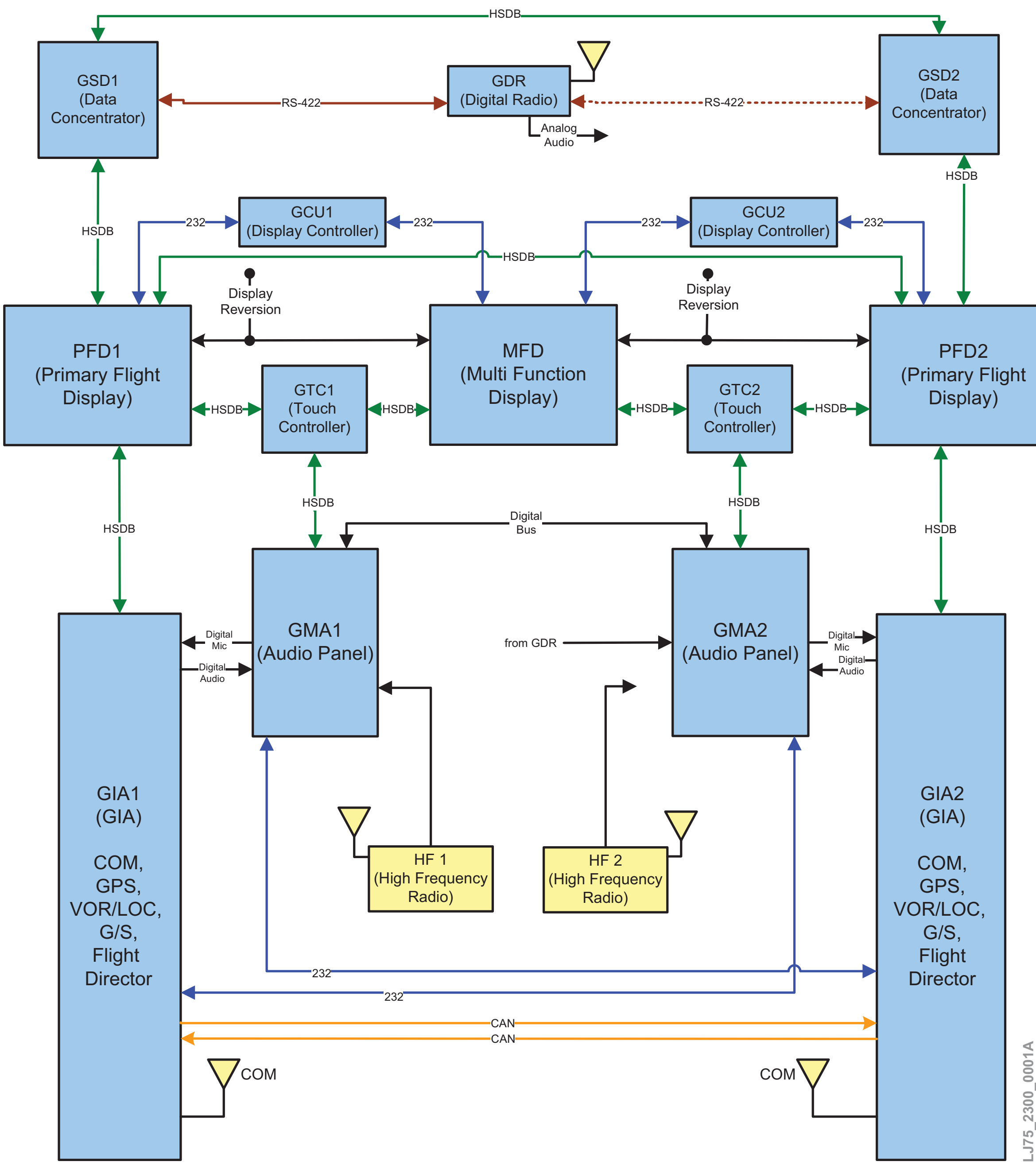


Fig. 1: Communications Block Diagram

VHF COMMUNICATION SYSTEM

(ATA 23-10-00)

OVERVIEW

The dual VHF communications (VHF COM) system provides airborne and ground VHF communications in a frequency range of 118.000 MHz to 137.000 MHz with a communication range of 200 nm.

COMPONENTS

Figure 2

The dual VHF COM system consists of two VHF COM (COM 1 and COM 2) transceivers, which are part of the integrated avionics units 1 and 2, respectively. An optional third VHF COM (COM 3) transceiver could also be installed.

The VHF COM system includes the following components:

- VHF COM antennas (2)

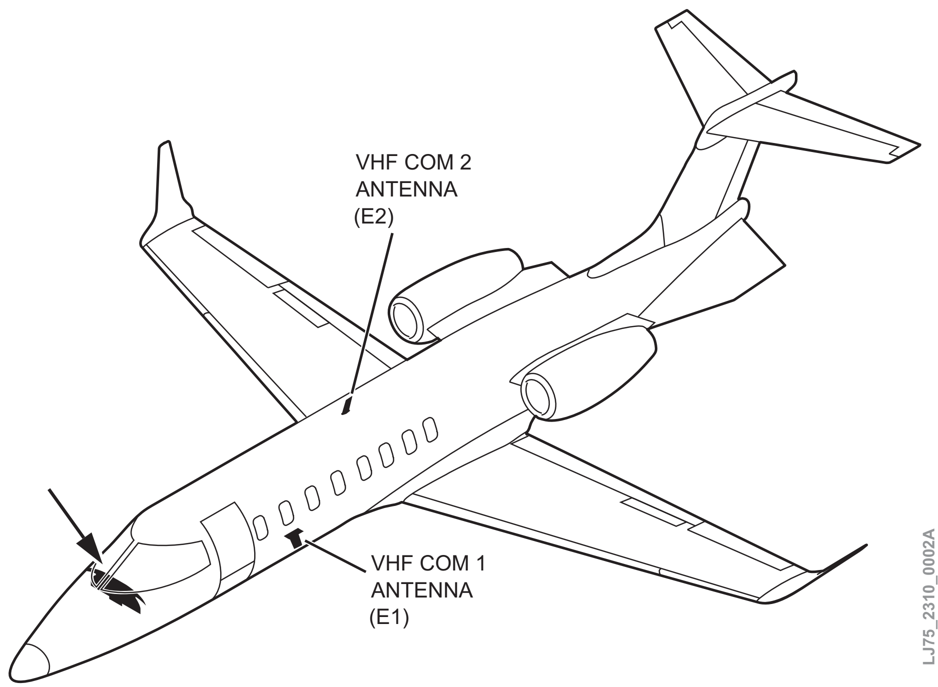


Fig. 2: VHF COMM System Component Locator

ASSOCIATED COMPONENTS

- Integrated avionics units (2)
- Audio processor units (2)
- Touch controllers (2)
- Remote controllers (2)
- Display units (3)
- Emergency communication switch (EMER COM switch)
- Clearance delivery switch (CLR DLY switch)

The optional COM 3 system could also be installed that includes the additional following components:

- VHF datalink (VDL) controller-pilot datalink communication (CPDLC) radio
- VHF datalink and COM 3 antenna

COMPONENT DESCRIPTION AND OPERATION

VHF COM Antennas

Figure 3

The two COM antennas are vertically polarized and operate in a frequency range of 116 to 152 MHz in both transmit and receive modes.

The COM 1 antenna is on the bottom of side of the fuselage at FS 302; the COM 2 antenna is on the top side of the fuselage at FS 377.

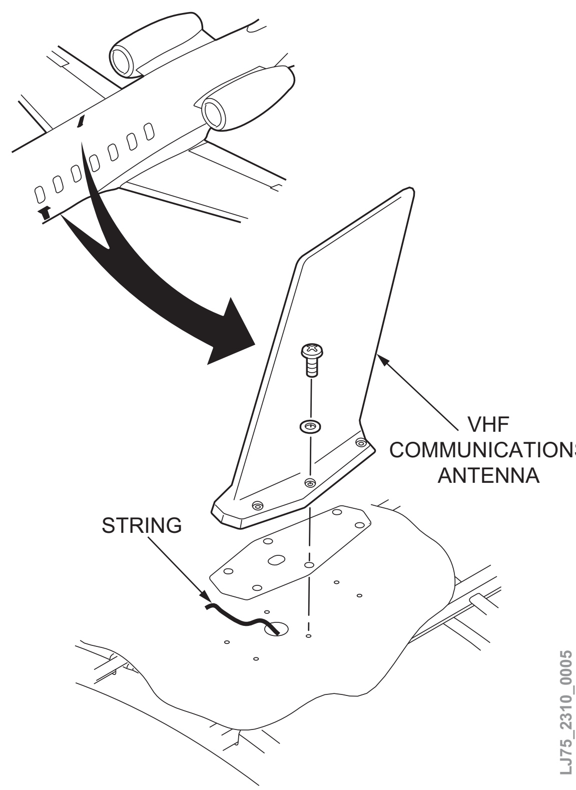


Fig. 3: VHF COM Antenna

ASSOCIATED COMPONENT DESCRIPTION AND OPERATION

Integrated Avionics Units

Figure 4

Each integrated avionics unit includes a single COM transceiver which supplies voice communication in the 118.000 MHz to 137.000 MHz frequency band. The integrated avionics unit 1 includes the COM 1 transceiver. The integrated avionics unit 2 includes the COM 2 transceiver. The transceivers consist of an amplitude modulated (AM) transmitter and a single conversion superheterodyne AM receiver.

The COM 1 and COM 2 radios are controlled by either touch controller (GTC) 1 or 2, or either pilot or copilot remote controller. The radios operate with channel spacing modes of 8.33 kHz or 25 kHz with an offset carrier capability in 25-kHz mode (receiver). The 8.33-kHz or 25-kHz channel spacing is controlled by the pilot and copilot from the GTC.

Each integrated avionics unit is paired with its onside primary flight display (PFD) from the high-speed data bus (HSDB) for configuration control. If a system data path failure occurs, the two integrated avionics units communicate directly with each other from the CAN protocol data bus.

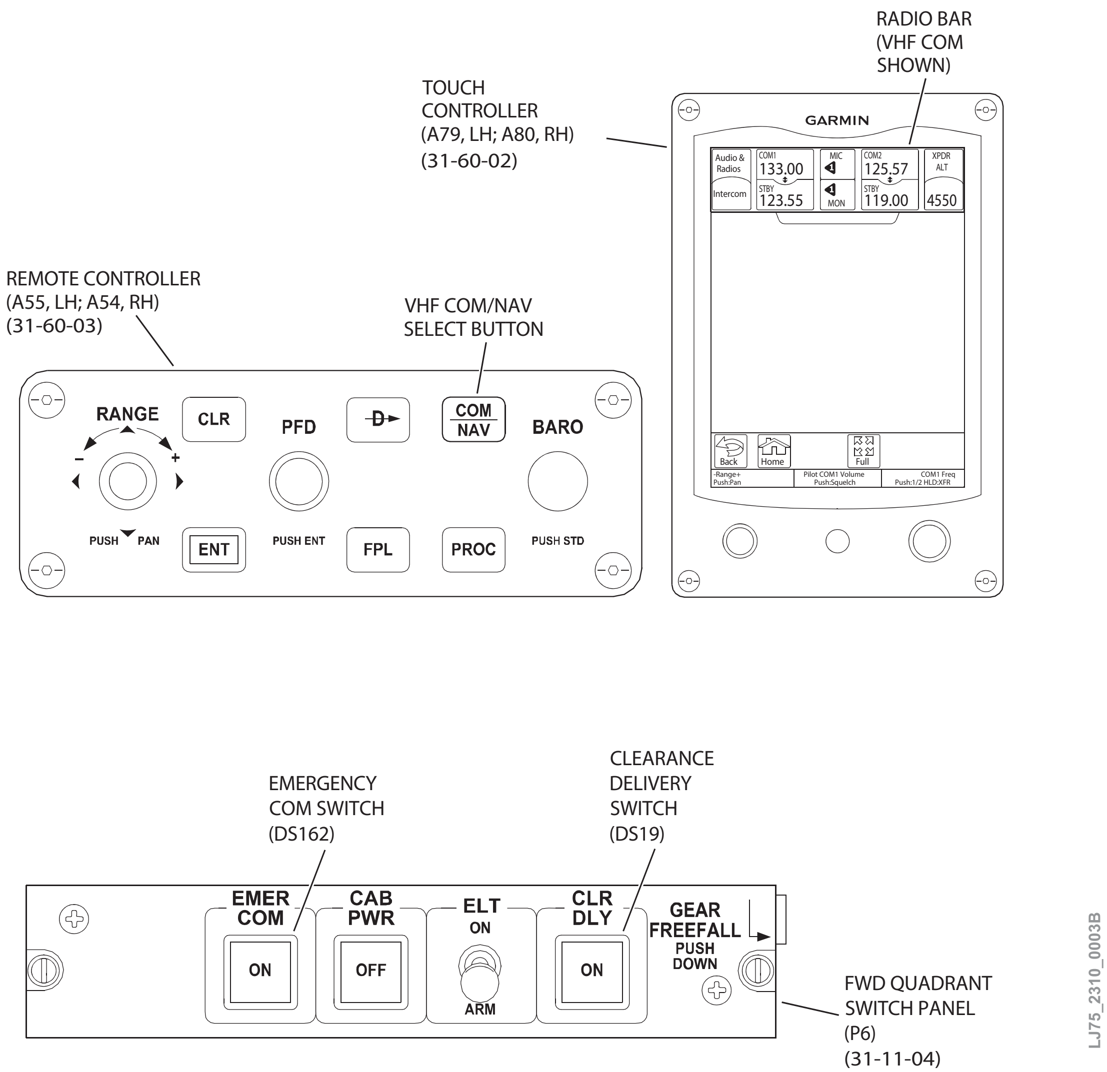


Fig. 4: VHF COMM System Components

Audio Processor Units

Figure 4

The audio processor units are digital mixers that send any combination of audio inputs to each audio output. The two audio processor units 1 and 2 integrate NAV/COM digital audio, intercom system, and marker beacon functions. Each audio processor unit communicates with its onside touch controller (GTC) from the high-speed databus (HSDB). As a backup control path, it also communicates with its cross-side integrated avionics unit from a RS-232 data bus.

The crew MIC audio, radio audio, and marker audio signals are sent through mono audio inputs. The COM, NAV, and aural alert audio signals are sent through digital audio inputs.

Crew headset audio signals are provided through analog stereo outputs. The COM MIC, speakers, and cockpit voice recorder (CVR) audio signals are sent through mono audio outputs. The COM MIC audio signals are sent through digital audio outputs. The ground crew MICs are hot at all time; there is no press-to-transmit (PTT) function necessary.

Refer to the audio integrating system section (23-51-00) for more details on the audio processor units' operation.

The audio processor units 1 and 2 are installed forward of DU 1 and DU 2. The audio processor unit 1 is installed forward of DU 1. The audio processor unit 2 is installed forward of DU 2.

Touch Controllers

Figure 4

The two touch controllers (GTC 1 and GTC 2 provide frequency tuning and display of all audio sources including COM 1, COM 2, and optional COM 3. GTC 1 and GTC 2 also provide control of the onside headset, volume of the selected audio source, auto/manual squelch, and microphone selection.

The GTCs provide pilot interactivity within fully integrated units. Aural feedback for a valid input broadcasts through headsets and speakers. Visual feedback for a valid input is provided on the GTCs. These aural and visual feedbacks provide system control acknowledgement to the flight crew.

The GTCs use an infrared grid to determine finger position on the screen. The GTCs can also be controlled by an operator who wears gloves. Refer to the electronic flight instrument system (EFIS) section (31-61-00) for more details on the GTCs operation.

Audio control and display is normally performed using the onside GTC. However, if a GTC fails, radios control could be provided by the remaining GTC or either the pilot or copilot remote controller.

GTC 1 and GTC 2 are installed below the DU 2 on the tilt panel.

Remote Controllers

Figure 4

The two remote controllers mainly perform inset map planning and ranging, adjust the barometric setting, and control the primary flight display (PFD) and multifunction flight display (MFD) functions.

The COM/NAV buttons on the flight crew remote controllers display a window/page that allows control of the COM or VHF NAV frequencies on the PFDs. The remote controllers are also used as redundant control for other radios. Refer to the electronic flight instrument system (EFIS) section (31-61-00) for more details on the remote controllers' operation.

The pilot and copilot remote controllers are installed in the glareshield facia panel above the DU 1 and DU 3, respectively.

Display Units

Figure 4

The three DUs are identical and consist of a 14-in. (35.6 cm) diagonal display unit. When set to PFD mode, the DUs display the COM frequencies. The DUs will also display functions when the remote controllers are in use.

All of the three display units, DU 1, DU 2, and DU 3, are installed side-by-side in the instrument panel. DU 1 is on the left side, DU 2 in the middle, and DU 3 on the right.

Emergency Communication Switch

Figure 4

The emergency communication (EMER COM) switch automatically tunes the COM 1 transceiver to the international standard emergency frequency of 121.5 MHz. When the EMER COM switch is pushed, no other frequency can be tuned.

The EMER COM switch is on the forward quad switch panel on the center pedestal.

Clearance Delivery Switch

Figure 4

The clearance delivery (CLR DLY) switch (DS19) provides selective power on the ground without powering all aircraft avionics units. When the CLR DLY switch is pushed, it powers the GTC 1, integrated avionics unit COM and NAV, audio processor units 1 and 2, and P6 panel switches only. The CLR DLY switch cannot be activated when power is applied to DU 1.

The CLR DLY switch is on the forward quad switch panel on the center pedestal.

OPTIONAL SYSTEMS

VHF Datalink CPDLC Radio

Figure 5

The VHF datalink (VDL) CPDLC radio includes the VHF COM 3 transceiver. The transceiver operates in the 118.000- to 136.992-MHz frequency band. Control and display for the COM 3 transceiver is provided by the GTCs from the audio processor units.

When the TX function is selected, the selected radio for keying is displayed on the PFD.

In addition to the COM 3 transceiver, the VDL CPDLC unit has datalink capabilities that include the CPDLC. Refer to the controller pilot datalink communications system section (23-25-00) for more details on the CPDLC system.

The VDL CPDLC radio is in the aft fuselage section next to the HF antenna coupler unit.

VHF Datalink and COM 3 Antenna

Figure 5

The VHF datalink and COM 3 antenna are vertically polarized and operate in a frequency range of 116 to 150 MHz.

The VHF COM 3 antenna is on the bottom side of the fuselage at FS 587.

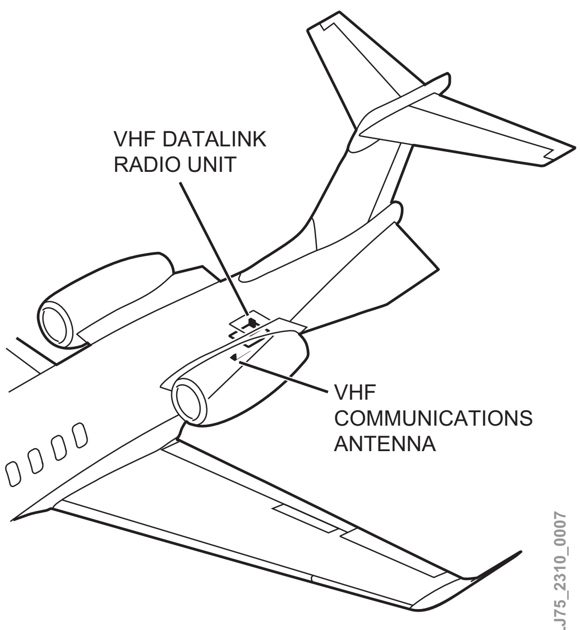


Fig. 5: VHF Datalink CPDLC

CONTROLS AND INDICATIONS

Figure 6

The active frequencies for COM 1 or COM 2 transceivers are shown on the upper right of the PFDs, depending on which TX is selected. The COM transceivers can be tuned at either 25-kHz frequency spacing (118.000 to 136.975 MHz) or 8.33-kHz spacing (118.000 to 136.990 MHz) for 760-channel or 3040-channel configuration. When 8.33-kHz channel spacing is selected, all of the 25-kHz channel spacing frequencies are also available in the complete 3040 channel list. The 8.33-kHz and 25-kHz frequency spacing selection is done from GTC 1 and GTC 2.

The COM frequencies and displays are controlled from the GTC 1, GTC 2, and the pilot and copilot remote controllers.

SYSTEM OPERATION

Figure 6

During normal operation, each GTC provides control to its onside radios (including COM). If a GTC fails, all radios are controlled by the remaining GTC or either the pilot or copilot remote controller.

The active COM frequency shows full-time on both PFDs and on the GTCs. The active COM frequency shows in (green) when the related COM radio is selected onside and a valid tuning echo frequency is received. The active COM frequency shows in (white) when the related COM radio is selected cross-side. The active COM frequency shows in (amber) if there is no valid tuning echo received for the set frequency. An (amber) X shows over the frequency box when the COM is unavailable.

During COM signal transmission, a (white) TX annunciator shows adjacent to the COM frequency on the GTCs and PFDs. During COM signal reception, a (white) RX annunciator shows adjacent to the COM frequency on the GTCs and PFDs. A (white) SQ annunciator shows adjacent to the COM frequency when the auto squelch is disabled. Standby frequencies for each of the COM radios are shown below their related active COM frequency on the GTCs.

When the same COM frequency is selected on both control panels, the pilot has transmit priority on COM 1 and the copilot has transmit priority on COM 2. When the COM system is turned on, the system remembers the last frequencies set and the active COM transceiver state prior to shutdown.

Optional COM 3

Just as for the COM 1 and COM 2 transceivers, the optional COM 3 transceiver also operates with 8.33-kHz or 25-kHz channel spacing. The TX annunciator shows adjacent to the COM 3 frequency on the GTCs during transmission. The RX annunciator shows adjacent to the COM 3 frequency during reception. The COM 3 radio has automatic or manual squelch control and a white SQ annunciator that shows adjacent to the COM 3 frequency when the automatic squelch is disabled.

COM Controls

The GTC 1, GTC 2, and the pilot and copilot backup controllers provide control for the COM transceivers.

The GTC allows the crew to perform the following:

- Manual tuning of active and standby COM 1, COM 2, and COM 3 frequencies
- Transfer of set standby frequencies to active frequencies
- Toggle COM squelch on/off
- Adjust COM radio volume
- Select 25-kHz or 8.33-kHz COM frequency spacing
- Enable/disable the automatic COM squelch
- Control MIC and MON buttons

The radio bar is always available on the GTC 1 and GTC 2. The radio bar includes the following information:

- Active and standby frequencies
- TX/RX indications
- SQ indication
- COM volume indication during audio level adjustment
- Active or standby COM selection indication
- Volume control on GTC from the related knob
- Frequency selection from knob control or from the GTC desktop
- MIC and MON button selections

COM Frequencies GTC Setup

Figure 6

The COM frequencies setup is performed from the radio bar, the audio and radio pages, and the Find COM Frequency pages.

COM Radio Bar

Pushing the COM 1 or COM 2 button swaps the active and standby frequencies with animation.

To change the frequency, the (cyan) cursor must be moved to the relevant field. This indicates that the relevant GTC knob controls that field.

Pushing the Enter button accepts the entered frequency. Pushing the XFER button accepts the entered frequency and swaps the active and standby frequencies.

Audio and Radios Page

The Pilot tab controls the pilot settings. The Copilot tab controls the copilot settings. The Cross-side tab is grayed out when both GTCs are available.

The cyan cursor shows the source controlled by the GTC knobs (where applicable). Turning the center knob controls the volume of the selected source. Pushing the center knob controls the squelch on and off for the selected COM. Pushing the right knob switches between COM 1 and COM 2. Rotating the outer knob edits the COM frequency to the left of the decimal. Rotating the inner knob edits the COM frequency to the right of the decimal.

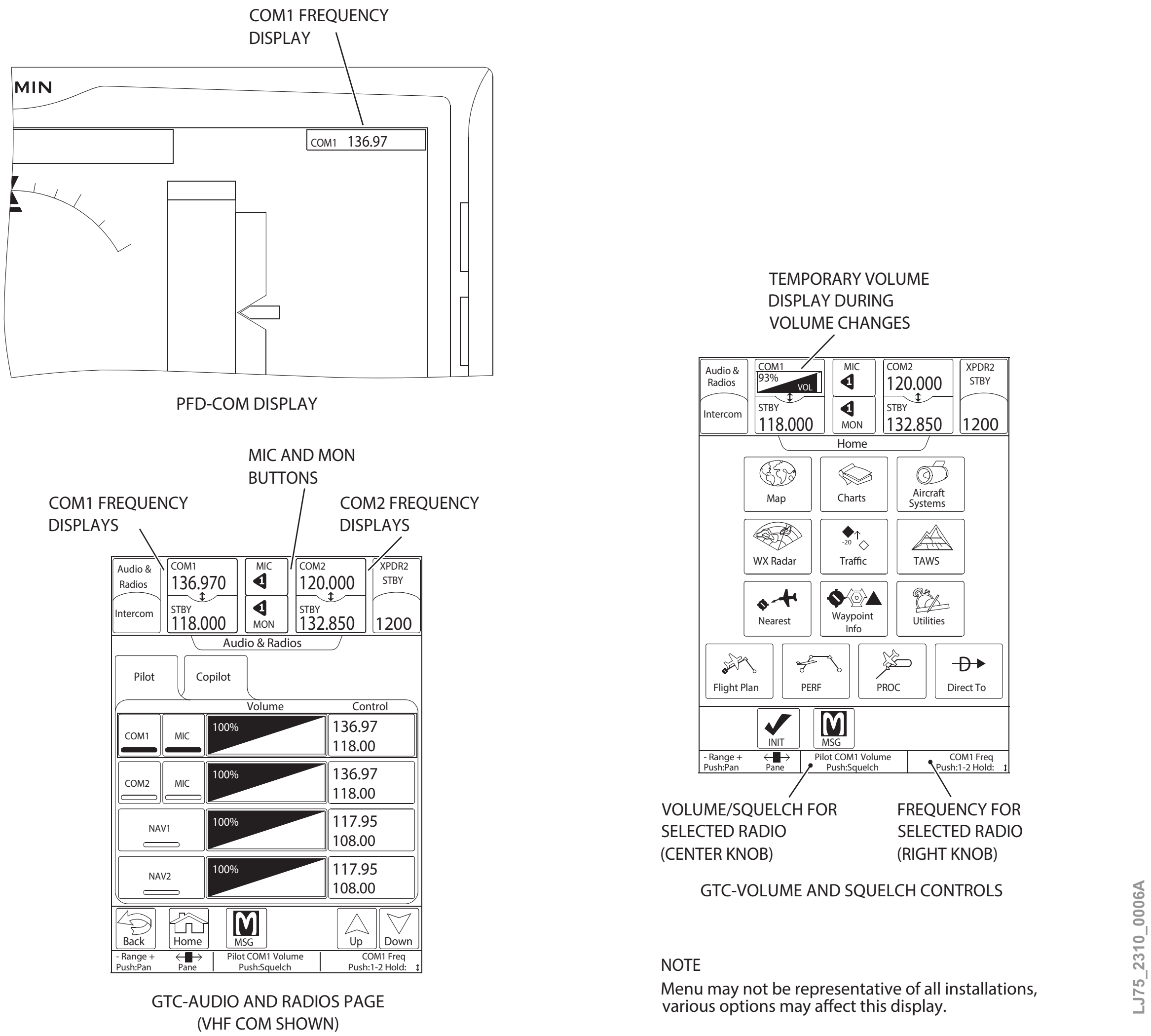


Fig. 6: COMM Display Pages

Find COM Frequency Pages

The Find COM Frequency pages can tune the COM radio. The Find COM Frequency pages are accessed from the magnifying glass icon on the GTC. Pushing the icon selects nearby, recently set, at destination, as-per-flight-plan, or set-as-favorite stations from the respective tab.

COM Controls from Remote Controllers

The pilot and copilot remote controllers perform the following functions:

- Tune the COM 1 and COM 2 active and standby frequencies
- Control the selected COM volume
- Change the onside audio processor units MIC/MON selections

Volume and Squelch

The GTC center knob controls the volume and squelch. The automatic squelch removes unwanted static noise when no audio signal is received, while still providing good sensitivity to weak COM signals.

When automatic squelch is disabled, COM audio reception remains on and continuous static noise is heard over the headsets and speakers. A white SQ annunciator appears adjacent to the COM frequency on the GTCs and PFDs, indicating the automatic squelch function is off.

MIC and MON Buttons (COM Operation)

The microphone MIC and audio monitoring MON buttons control from which COM stations the crew transmits (MIC) and to which COM stations they listen (MON). These functions are also used with other radios.

The MIC and MON functions are controlled from the GTC radio bar or from the remote controllers. The green triangle annunciators are used with both MIC and MON buttons to identify which stations are selected for these two functions. If a GTC fails, the MIC and MON buttons show the pilot and copilot mode status separated with a slash.

For instance, during normal operation, if the MIC button on GTC 1 shows a green triangle pointing left with a 1 in it, this indicates that the pilot is set to transmit on the COM 1 station. Pushing the MIC button again changes the selection to COM 2 and vice versa. During transmission, the MIC indicator of the transmitting source blinks on and off.

With the MON function, two COM stations may be monitored in the headset at the same time. In this situation, two triangles show: one pointing to COM 1 and the other to COM 2.

Pushing the MON button while a COM station is the selected MON toggles monitoring to the other COM station.

Pushing the MIC button while the passenger address (PA) is selected, switches the MIC to the last selected COM. Pushing the MON button while the PA is selected brings the Audio and Radios page into view.

If an audio processor unit fails, the related MIC and MON buttons would be replaced with an amber X.

EMER COM Mode

Pushing the EMER COM switch on the forward quadrant switch panel manually enables and disables the EMER COM mode. However, the EMER COM mode will be automatically set if communication is lost with the integrated avionics main subsystem.

If the EMER COM mode has been triggered automatically, COM 2 is automatically tuned to the emergency frequency (121.5 MHz). The related standby frequency shows EMER, indicating to the crew that manual tuning of COM 1 is not possible. Tuning to an alternative frequency is also prevented.

However, during EMER COM operation, the audio panel is configured to allow a COM 1 signal to pass through unaffected. When a valid tuning echo is received from the COM 1 radio, the active frequency shows in green. If the COM 1 radio tuning echo is invalid or missing, the active frequency shows in amber, indicating the system cannot confirm COM 1 is in an EMER COM mode.

When the crew uses the EMER COM switch to cancel the EMER COM mode, the radio restores the previously selected active and standby COM 1 frequencies and removes the EMER annunciation.

In the EMER COM mode, the microphones and headsets are directly connected to their onside COM radio (failsafe mode).

Audio Integrating System Interface

The audio integrating system allows the flight crew to control the audio for each headset and microphone, as well as the cockpit speakers, intercom, and PA system. The controls include source selection, microphone selection, volume control, squelch, and intercom selection. Oxygen/MIC switches are available for both crewmembers to change from headset MICs to oxygen mask MICs when oxygen masks are necessary. Refer to the audio integrating system section (23-51-00) for more details.

Power

Figure 7 and Table 1

Integrated avionics unit 1 is energized from the GIA COMM 1 PRI circuit breaker (through the cockpit miscellaneous P11 relay panel) from the left essential bus on the pilot circuit breaker (CB) panel. It is also energized from the GIA COMM 1 SEC circuit breaker from the right main avionics bus on the copilot CB panel. Integrated avionics unit 2 is energized from the GIA COMM 2 circuit breaker from the right essential bus on the copilot CB panel.

Touch controller 1 is energized from the GTC 1 circuit breaker from the emer battery bus on the pilot CB panel. Touch controller 2 is energized from the GTC 2 circuit breaker from the right essential bus on the copilot CB panel.

Pilot remote controller is energized from the L RMT CTRL circuit breaker from the left essential bus on the pilot CB panel. Copilot remote controller is energized from the R RMT CTRL circuit breaker from the right essential bus on the copilot CB panel.

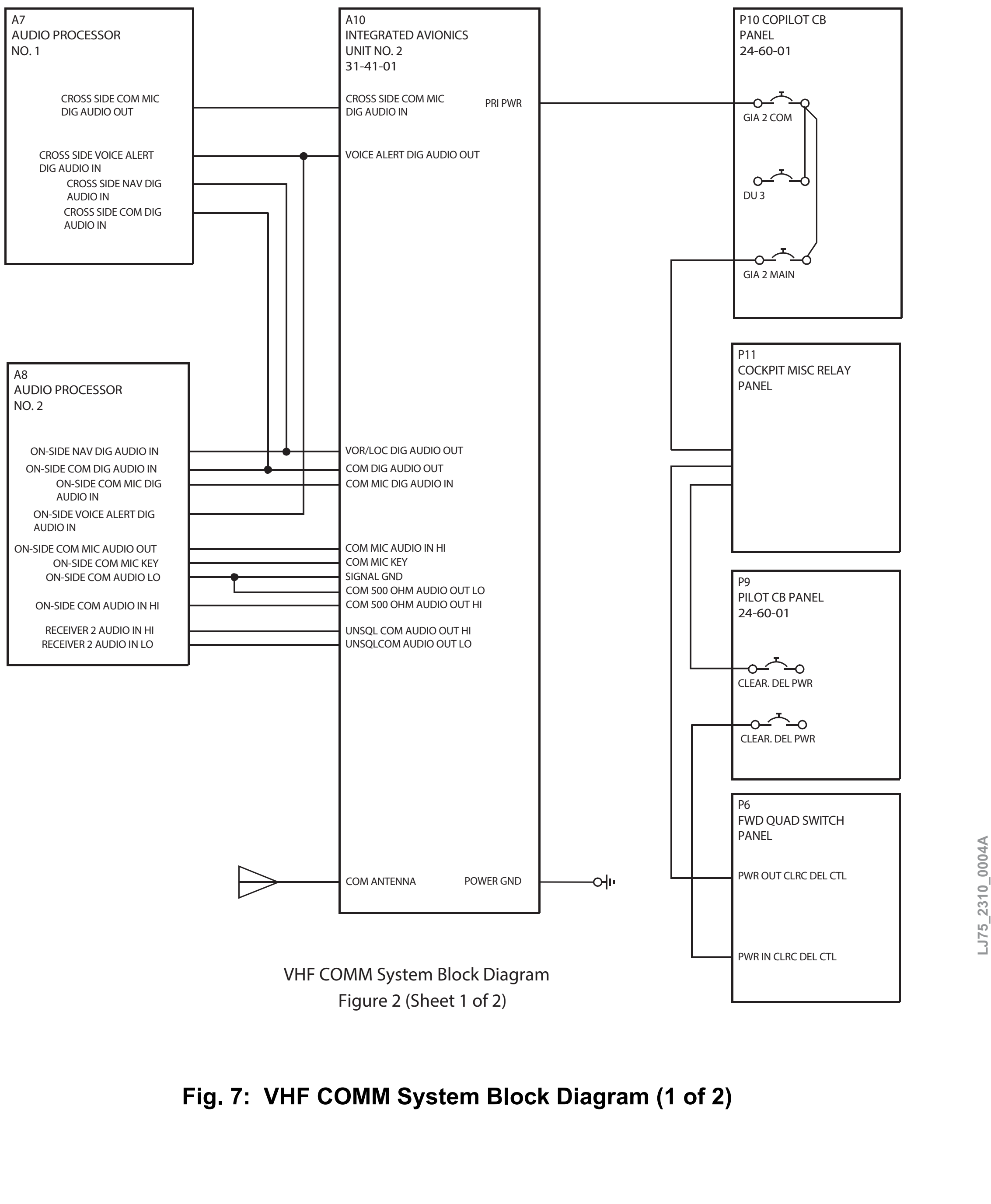
Audio processor unit 1 is energized from the AUDIO 1 circuit breaker (through the cockpit miscellaneous P11 relay panel) from the left essential bus on the pilot CB panel. Audio processor unit 2 is energized from the AUDIO 2 circuit breaker (through the cockpit miscellaneous P11 relay panel) from the right essential bus on the copilot CB panel.

Display unit DU 1 is energized from the DU 1 circuit breaker from the left essential avionics bus on the pilot CB panel. Display unit DU 2 is energized from the DU 2 circuit breaker from the left essential avionics bus on the pilot CB panel. Display unit DU 3 is energized from the DU 3 circuit breaker from the right essential avionics bus on the copilot CB panel.

The EMER COM switch is energized from the CLEARANCE DEL CTRL and CLEARANCE DEL PWR circuit breakers from the left hot bus on the pilot CB panel.

The clearance delivery CLR DLY switch is energized from the CLEARANCE DEL CTRL and CLEARANCE DEL PWR circuit breakers from the left hot bus on the pilot CB panel.

The optional VHF datalink (VDL) CPDLC radio is energized from the COMM 3/CPDLC circuit breaker from the right main avionics bus on the copilot CB panel.



VHF COMM System Block Diagram
Figure 2 (Sheet 1 of 2)

Fig. 7: VHF COMM System Block Diagram (1 of 2)

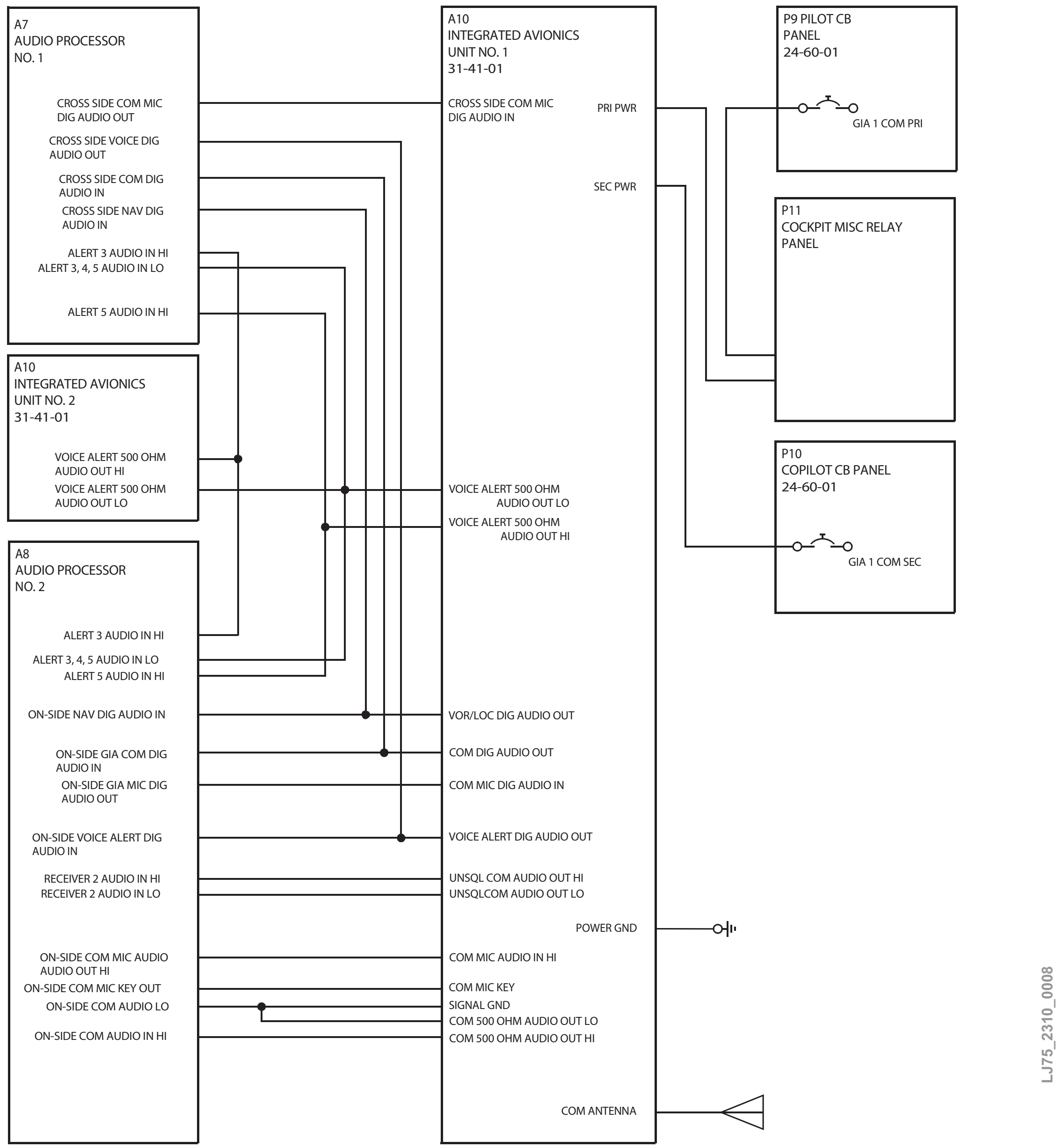


Fig. 8: VHF COMM System Block Diagram (2 of 2)

FAULT INDICATION

Table 1: VHF Communication System – CAS Messages

CAS MESSAGE	LOGIC
COM 1/2 STUCK MIC	Either COM system message has been triggered
COM 3 STUCK MIC	COM 3 system message has been triggered
CLR DLY ON	CLR DLY switch is pressed in indicating CLR DLY switch has been selected ON

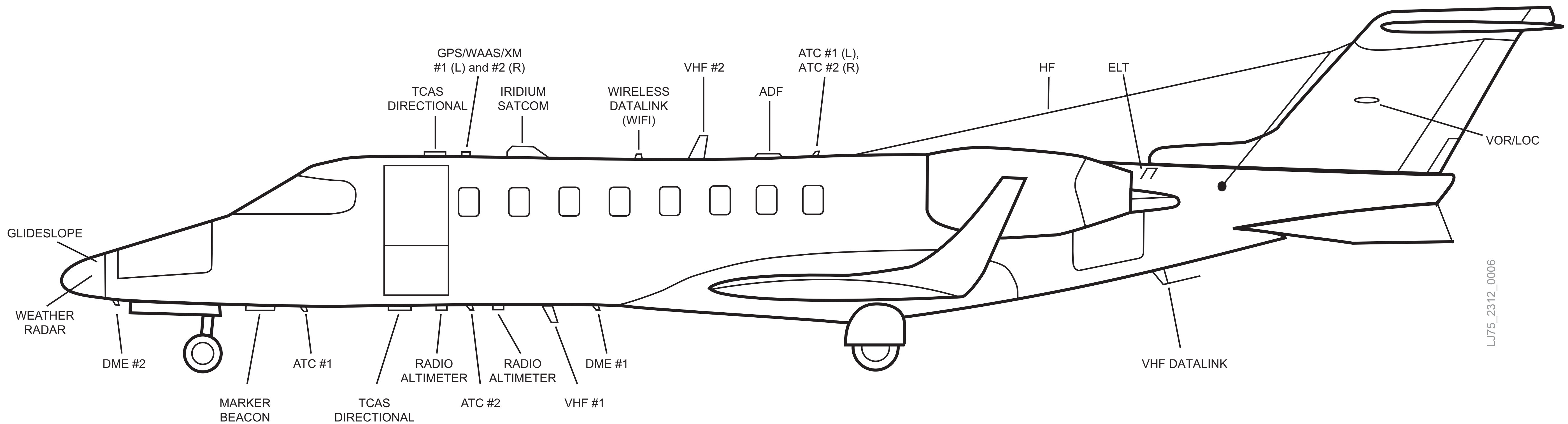


Fig. 1: Learjet 70/75 Antenna Locator

This page intentionally left blank

HF COMMUNICATION SYSTEM

(ATA 23-12-00)

OVERVIEW

The optional (single or dual) HF communication system supplies long-range air-to-ground and air-to-air voice communications. The HF communication system frequency range is from 2.000.0 to 29.9999 MHz in 0.1 MHz increments.

The system can operate in a channel mode or direct frequency mode. In the channel mode, 99 frequencies can be preset for selection. Each channel can be set to operate as half-duplex, simplex, or receive only. In the direct frequency mode, the individual digits are changed to the applicable frequency.

COMPONENTS

The HF communication system consists of:

- Power amplifier
- Antenna coupler
- HF receiver-exciter
- Antenna and coax feed-thru insulator
- Antenna fuse block
- Remote circuit breakers

ASSOCIATED COMPONENTS

- Touch controllers (GTCs)
- Serial Data Concentrator Unit 1
- Serial Data Concentrator Unit 2

COMPONENT DESCRIPTION AND OPERATION

Power Amplifier

Figure 11

Located in the right aft avionics compartment on the top equipment shelf. It is mounted near the antenna to maximize efficiency.

The power amplifier amplifies the signals from the HF 1050 receiver and then outputs the signal to the antenna coupler. The power amplifier is capable of linear amplification of an OdBm (1mW) signal to a 53 dBm. (200W) output level at 50 ohms input and output impedance.

Antenna Coupler

The antenna couplers match the selected transmit frequency in the transceiver to the antenna to allow maximum power to the antenna.The antenna couplers are pressurized with nitrogen to 6 ±1 psi to prevent the accumulation of condensation which could cause arcing in the box during operation.

HF Receiver/Exciter

Figure 11

Located in the right aft avionics compartment on the top equipment shelf. The receiver operates in the HF band from 2.0000 to 29.9999 MHz synthesized in 100 Hz steps.

The HF 1050 receiver is controlled by the GTC through an ARINC 429 data bus.

Antenna and Coax Feed-Through Insulator

Figure 12

Wire-type antenna on the top of the aircraft is connected from a bracket on the top of the fuselage, through a tension unit at the top of the vertical stabilizer leading edge, to the feed-through insulator on the upper-left side of the tailcone.

Antenna Fuse Block

Figure 10

Located in the right aft avionics compartment on the top equipment shelf.

Remote Circuit Breakers

Figure 10

Located above the external baggage bay. Power for HF system operation is provided by the left main 28 VDC via the left aft PDP. Power is controlled by the HF1 circuit breaker on the pilot circuit breaker panel.

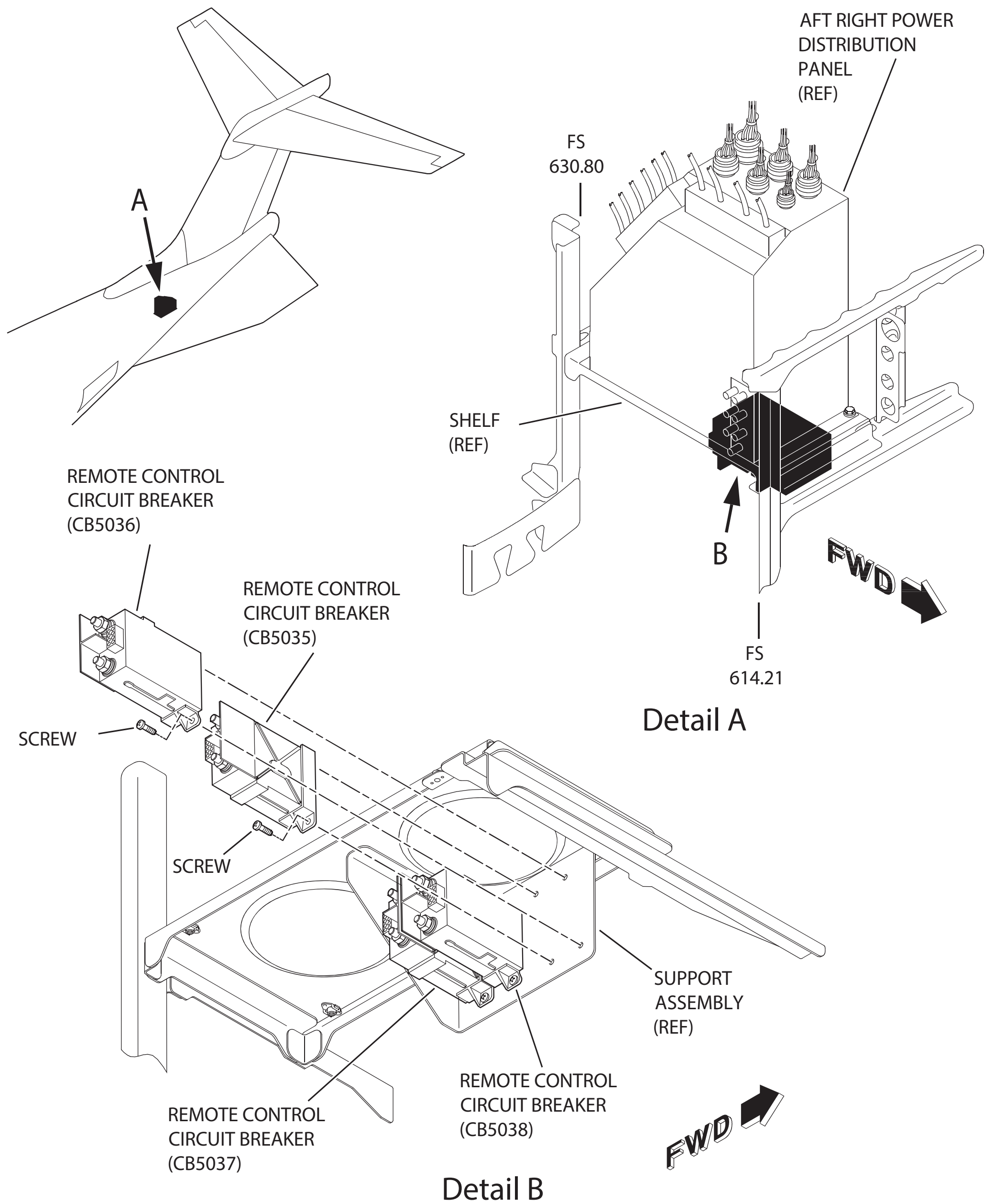


Fig. 10: HF Remote Circuit Breaker Location

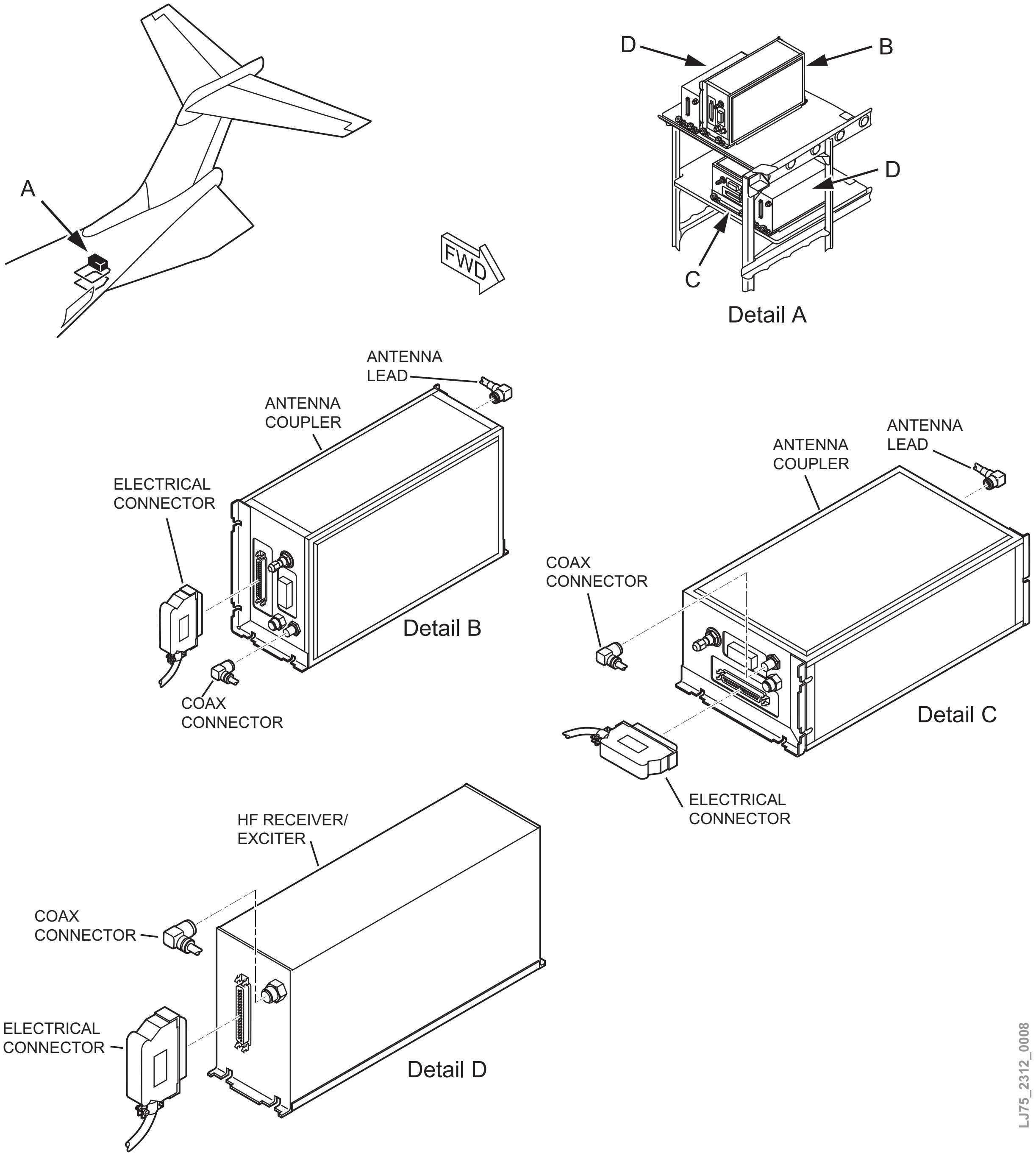


Fig. 11: HF Components

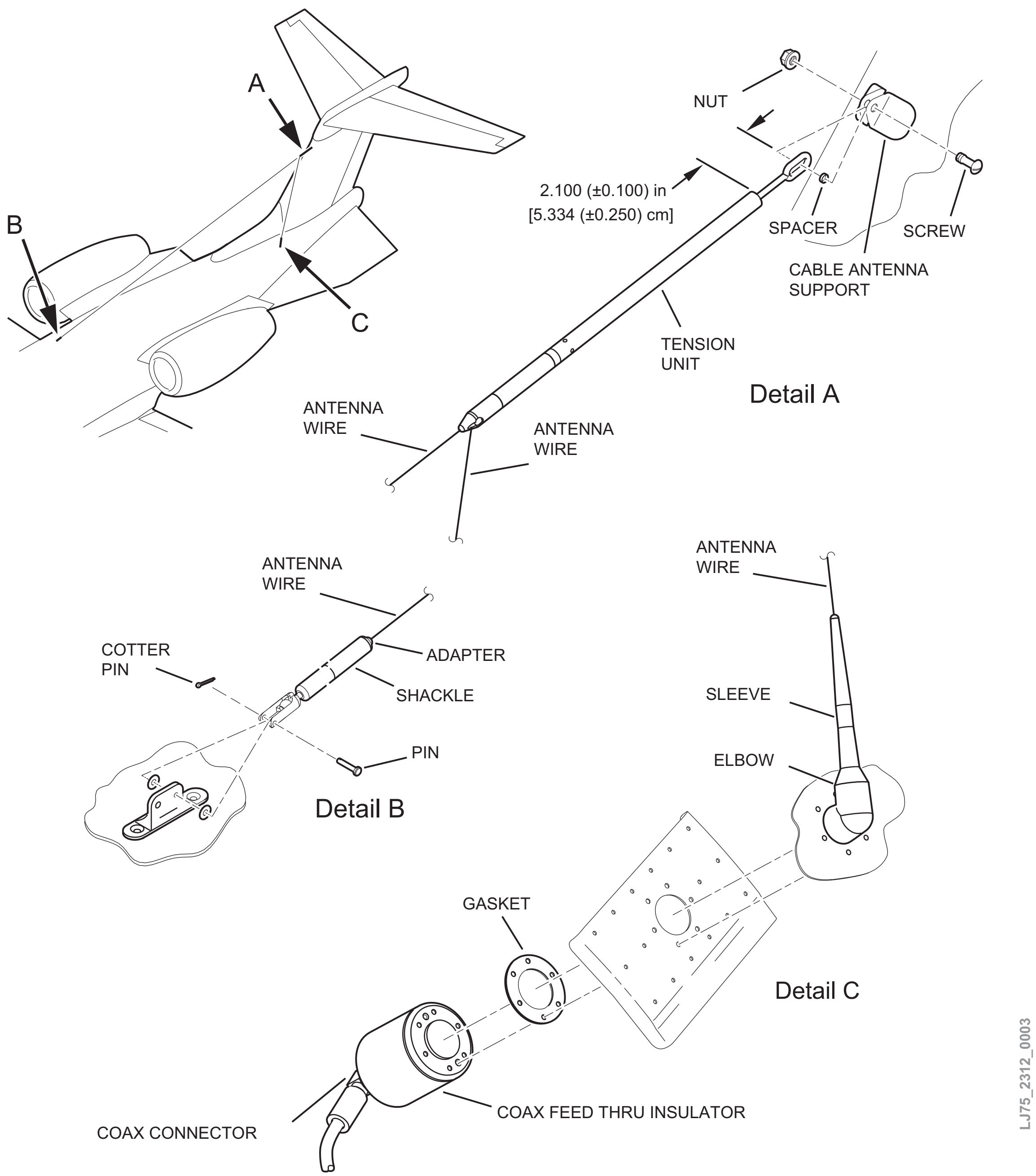


Fig. 12: HF Antenna and Coax Feed

ASSOCIATED COMPONENTS

Figure 13

Touch Controllers

The controllers are located on the instrument touch panel and used to control the HF communications.

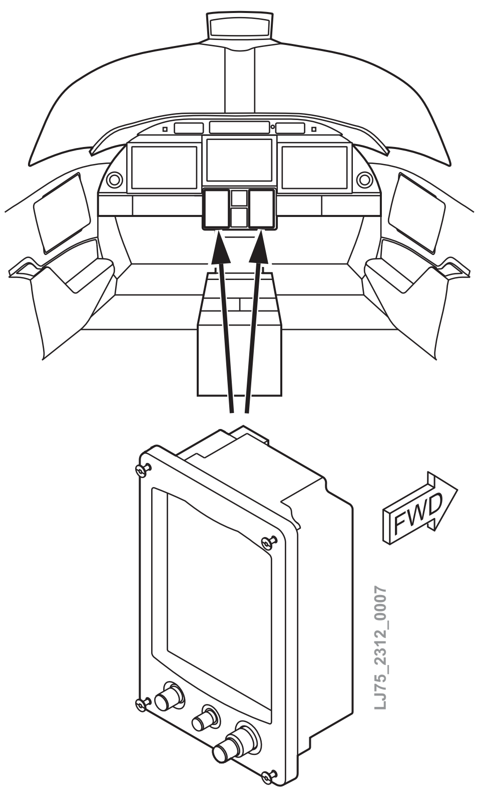


Fig. 13: Touch Controllers

Serial Data Concentrator Units

Figure 14

The serial data concentrator units 1 and 2 include interfaces that operate the common HSDB protocol. Data on the HSDB network has a source and a destination. Data is dynamically routed through the systems from source to destination via the serial data concentrator units.

The two serial data concentrator units are installed forward of DU 2.

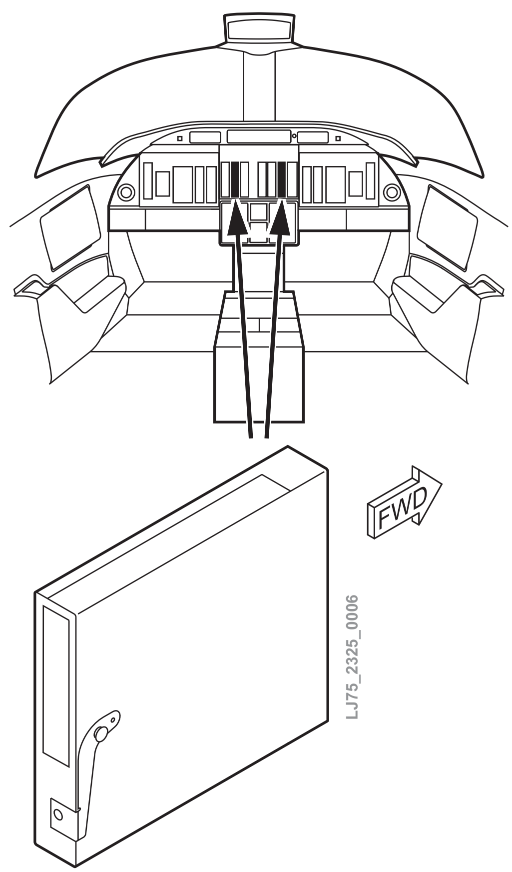


Fig. 14: Serial Data Concentrator Units

SYSTEM OPERATION

Figure 15 through 25

The HF communication system is controlled by the touch controllers as follows:

- Center knob—Adjusts volume level
- Right outer knob—Edits frequency to the left of the decimal
- Right inner knob—Edits frequency to the right of the decimal
- Audio and Radios page data/controls.:
  - HF audio and mic selection on/off for the selected crewmember
  - HF volume adjustment for the selected crewmember
  - Currently tuned frequency display
  - Selected emission modes display
  - Transmission status display (blank, TX, TUNING, tuning in progress, or TUNEFAIL)
  - Selected squelch levels display
- HF control page data/controls:
  - Active and standby settings display: frequencies, emission mode, tuning mode, active transmission status (blank, TX, TUNING, or TUNE-FAIL)
  - Current transmit power display
  - Current squelch level display
  - Frequency transfer from standby to active (by pressing the active frequency)
  - Dedicated page access for the following: standby frequency tuning, tuning mode, squelch level, emission mode, and transmit power
- HF tuning mode page data/controls:
  - Selection from simple and duplex controls
- HF squelch level page data/controls:
  - Selection from SQ0, SQ1, SQ2, and SQ3 levels
- HF emission mode page data/controls:
  - Selection UV, LV, and AM modes
- HF transmit power page data/controls:
  - Selection from low, medium, or high transmit powers

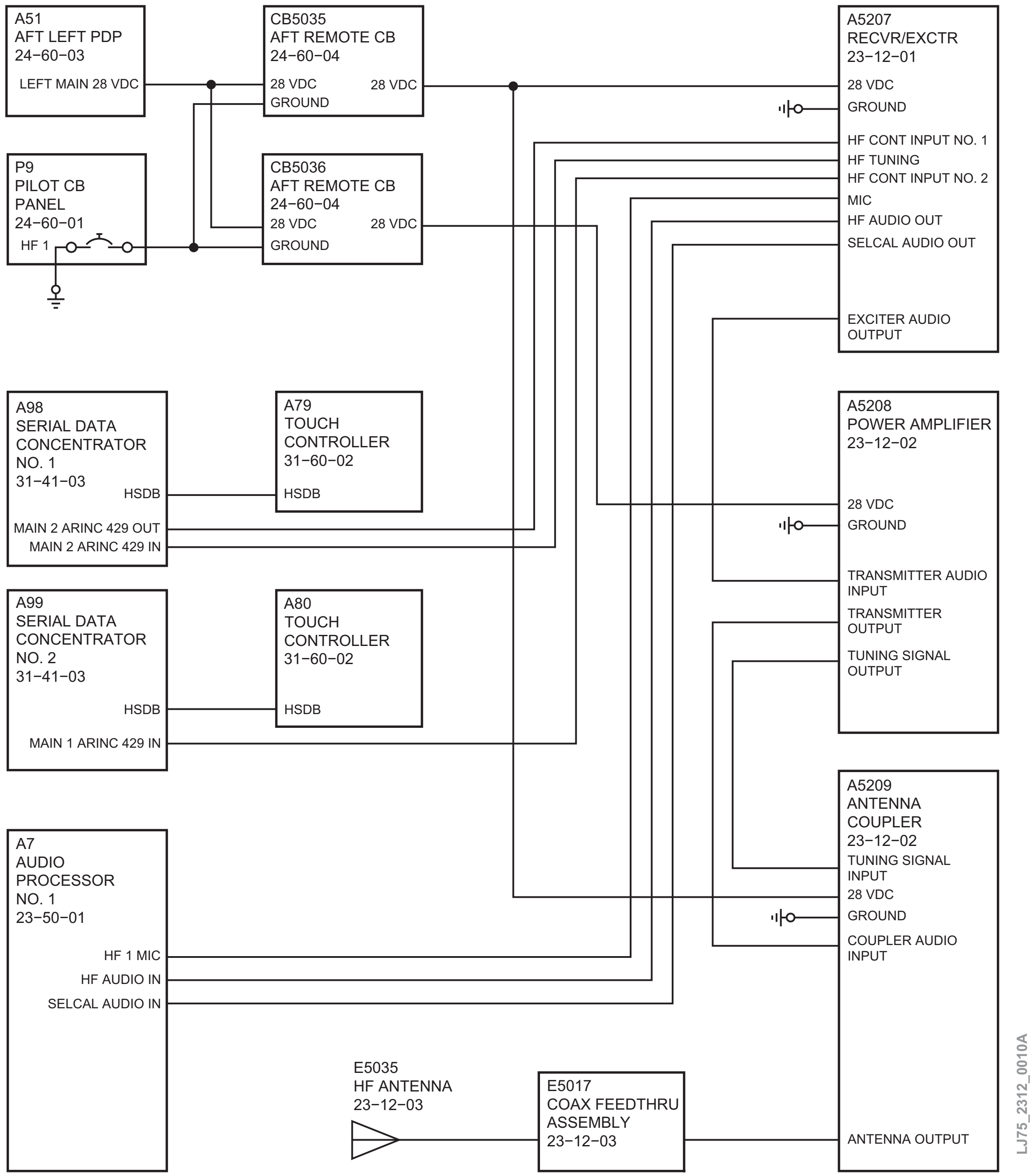


Fig. 15: HF System Block Diagram

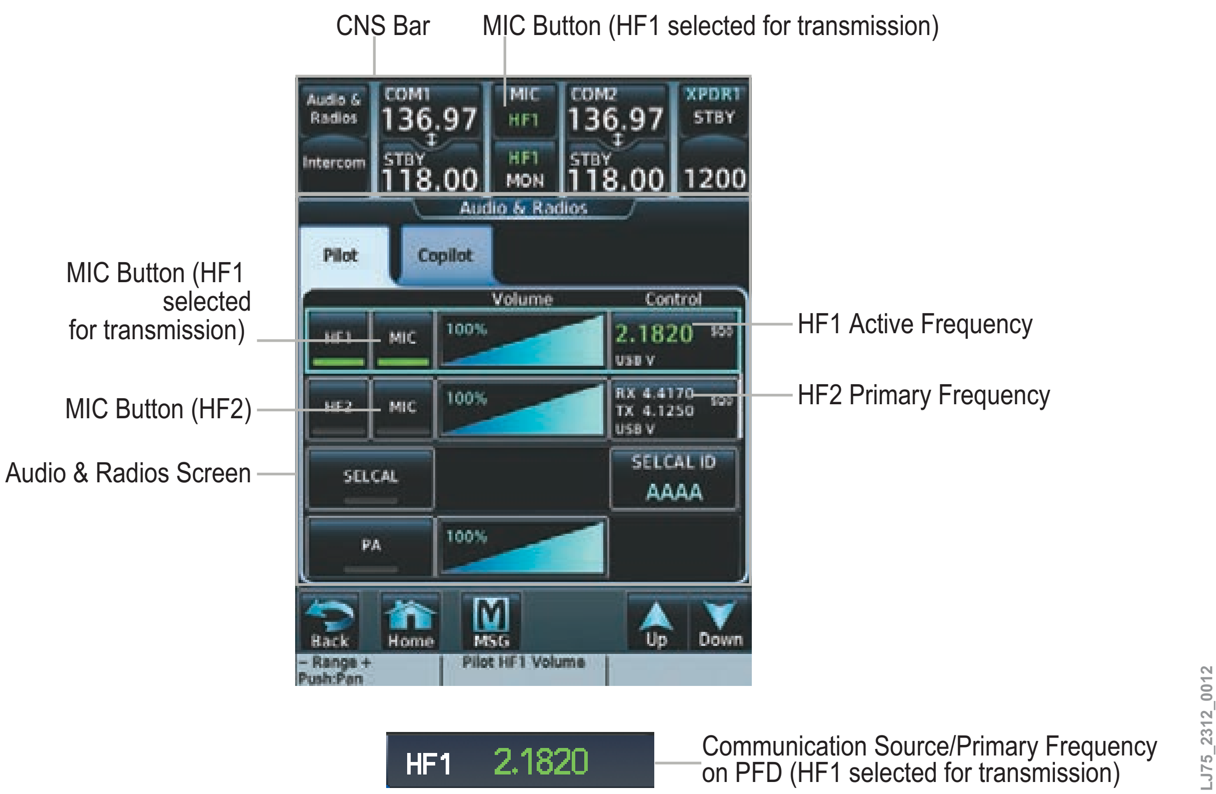


Fig. 16: Selecting an HF COM Radio for Transmission (Simplex Tuning Mode)

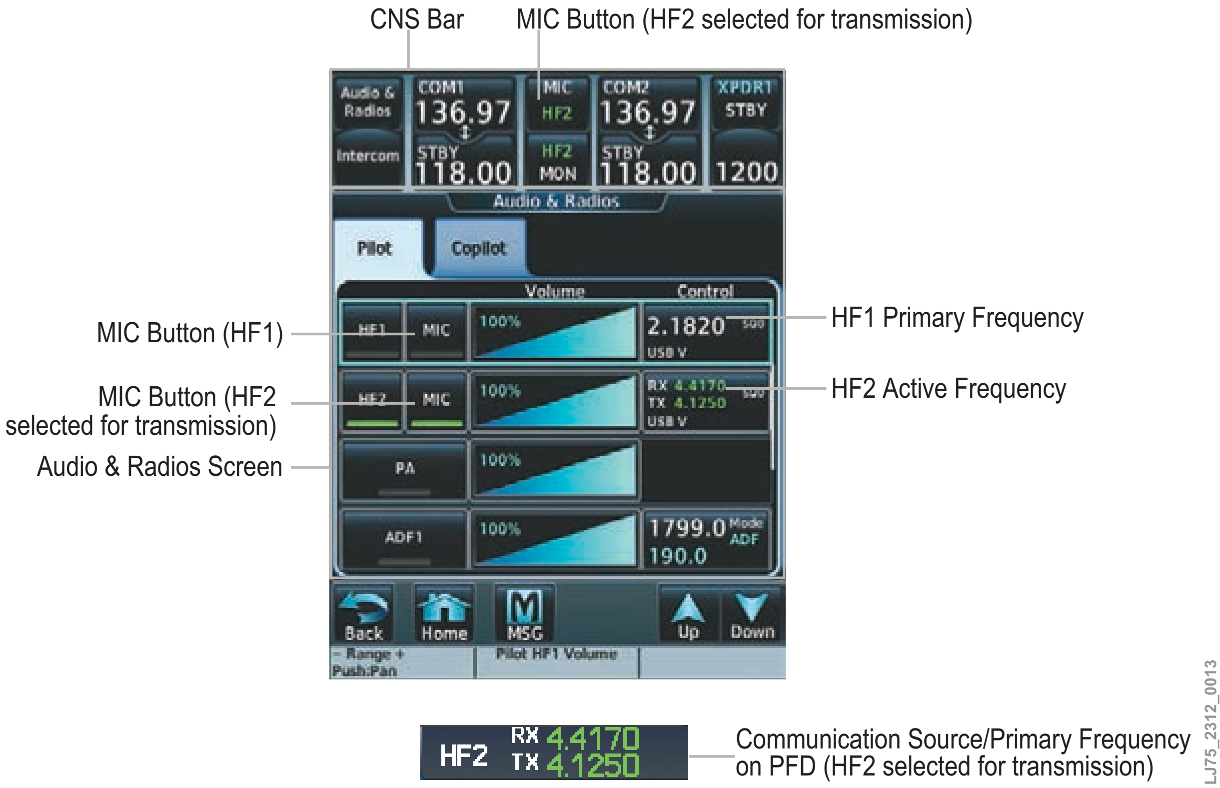


Fig. 17: Selecting an HF COM Radio for Transmission (Duplex Tuning Mode)

Indication	Description
TESTING	HF COM testing is in progress.
TEST FAIL	HF COM testing failed.
TUNING	HF COM tuning is in progress.
TUNE FAIL	HF COM tuning failed.
TX	HF COM transmission is in progress.

LJ75_2312_0014

Fig. 18: HF COM Transmission Status

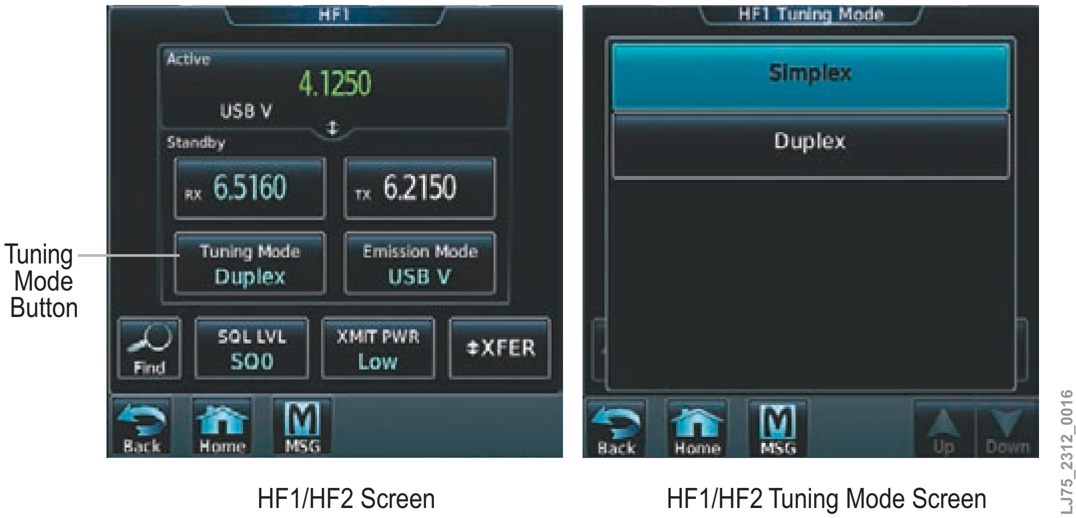
Audio & Radios Screen - HF1/HF2 Frequency Tuning

HF1/HF2 Screen - HF1/HF2 Frequency Tuning

HF1/HF2 Standby Screen - Frequency Tuning Keypad

HF1/HF2 Screen

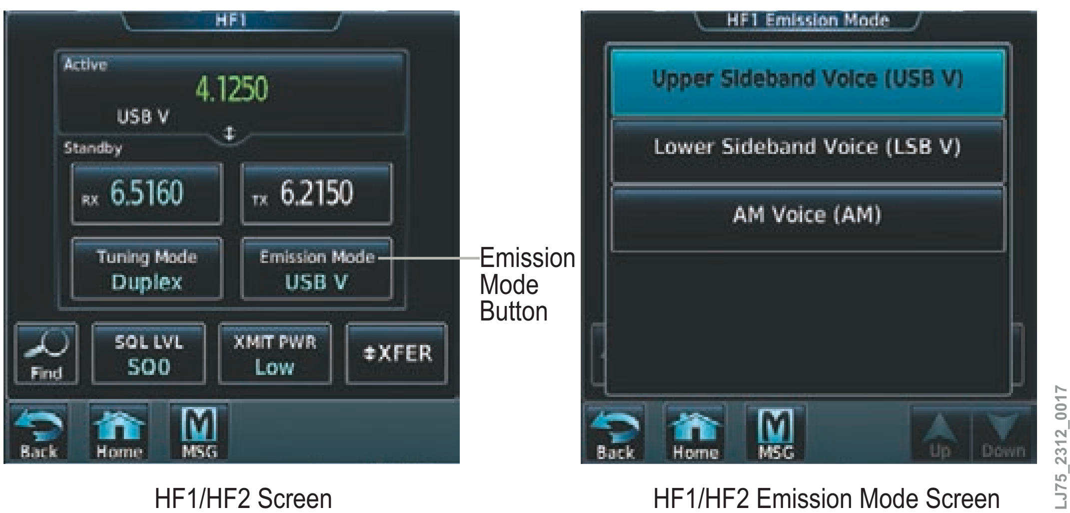
Fig. 19: HF1/HF2 Frequency Tuning



HF1/HF2 Screen

HF1/HF2 Tuning Mode Screen

Fig. 20: HF1/HF2 Tuning Mode Screen



HF1/HF2 Screen

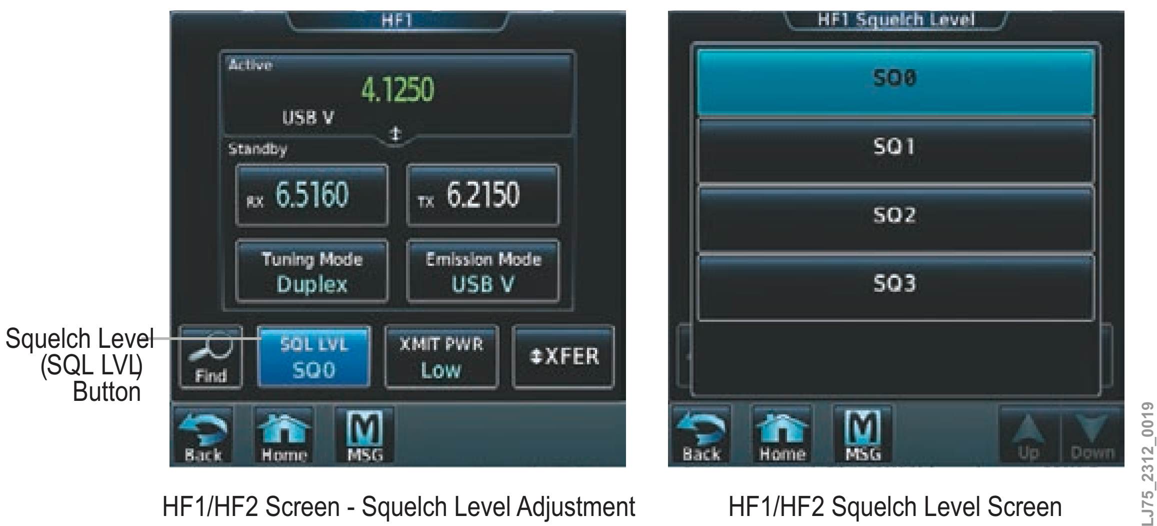
HF1/HF2 Emission Mode Screen

Fig. 21: HF1/HF2 Emission Mode Screen

HF1/HF2 Screen

Find HF Channel Screen

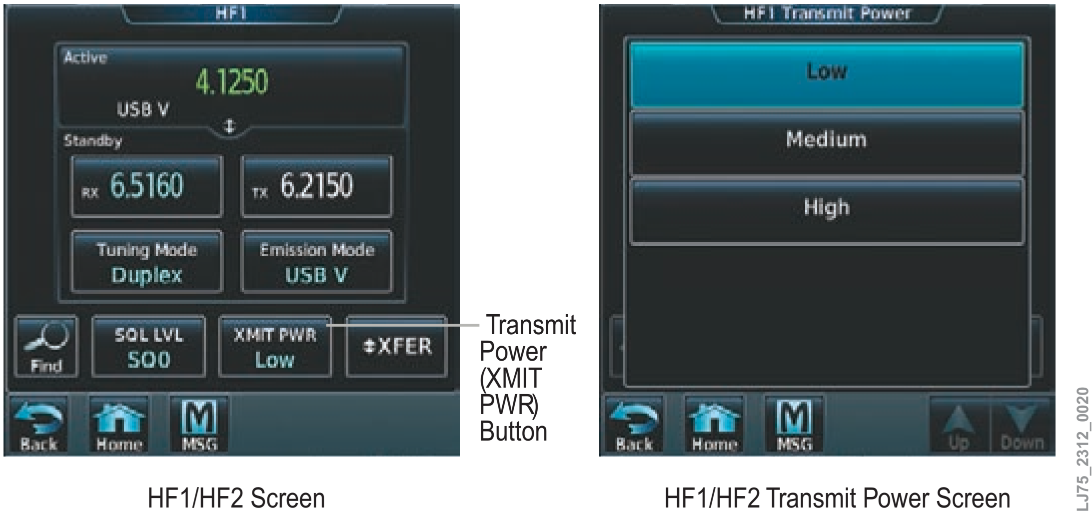
Fig. 22: HF1/HF2 Channel Screen



HF1/HF2 Screen - Squelch Level Adjustment

HF1/HF2 Squelch Level Screen

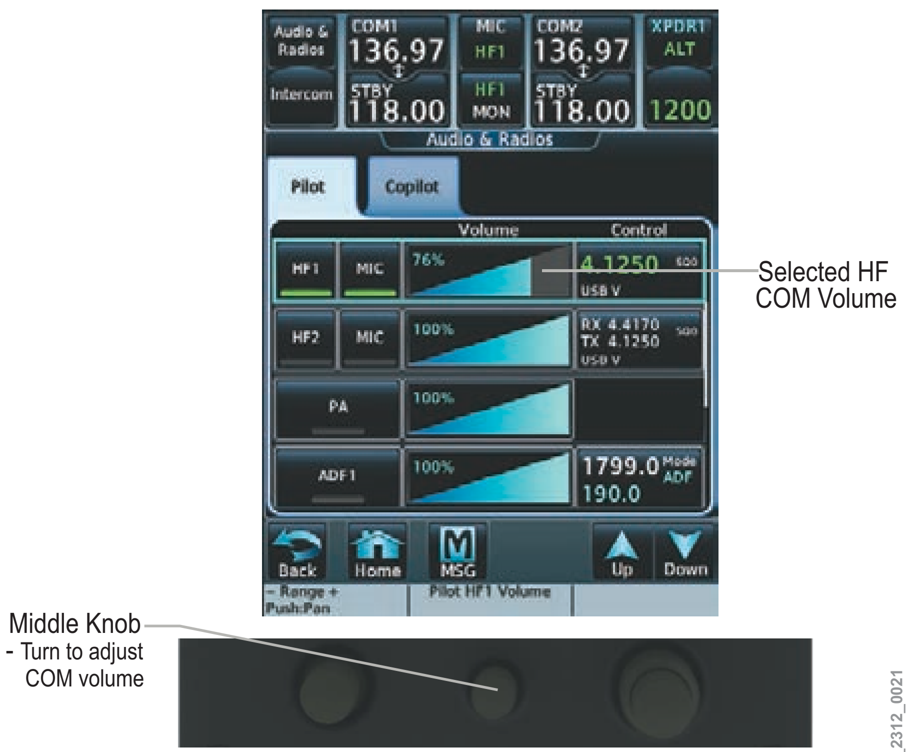
Fig. 23: HF1/HF2 Squelch Level Screen



HF1/HF2 Screen

HF1/HF2 Transmit Power Screen

Fig. 24: HF1/HF2 Transmit Power Screen



COM Volume Level

Fig. 25: COM Volume Level

IRIDIUM SATCOM SYSTEM

(ATA 23-15-00)

OVERVIEW

The optional Iridium SATCOM system uses satellites positioned in space for voice and data telecommunications. It consists of an Iridium transceiver and a SATCOM antenna.

COMPONENTS

The Iridium SATCOM system includes the following components:

- SATCOM transceiver
- SATCOM antenna

ASSOCIATED COMPONENTS

The SATCOM system includes the following associated components:

- Maintenance data recorder and wireless datalink unit
- Touch controllers
- Display units
- Audio processor units

COMPONENT DESCRIPTION

SATCOM Transceiver

Figure 26

The SATCOM transceiver is located in the left side of the avionics nose compartment at FS 141 and provides the capability for worldwide graphical weather via Iridium Router-Based Unrestricted Digital Interworking Connectivity Solution (RUDICS) Data Services.

The GSR provides graphical and textual weather that is displayed in the moving maps and supports cockpit integrated phone, cockpit SMS texting capabilities, two cabin handsets, and in-air remote maintenance datalink via low speed RS232 to the flight parameter recorder unit.

SATCOM Antenna

Figure 26

The SATCOM antenna is located on the top of the aircraft at FS 318.

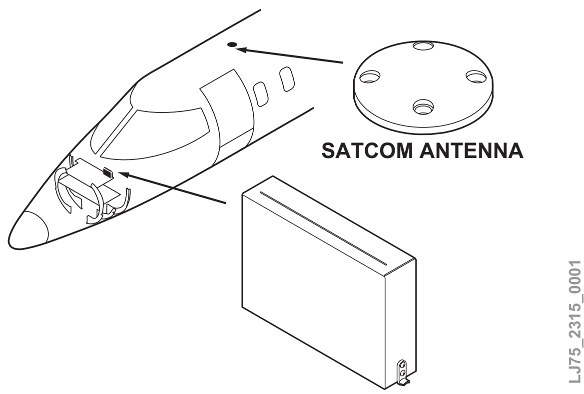


Fig. 26: SATCOM Transceiver and Antenna

Maintenance Data Recorder and Wireless Datalink Unit

Figure 27

The maintenance data recorder and wireless datalink unit is located in the aircraft nose.

The unit provides a flight parameter recorder function and a high-speed data link between the aircraft systems and ground computers using 802.11g (Wi-Fi) while the aircraft is on the ground. (Refer to 45-45-00).

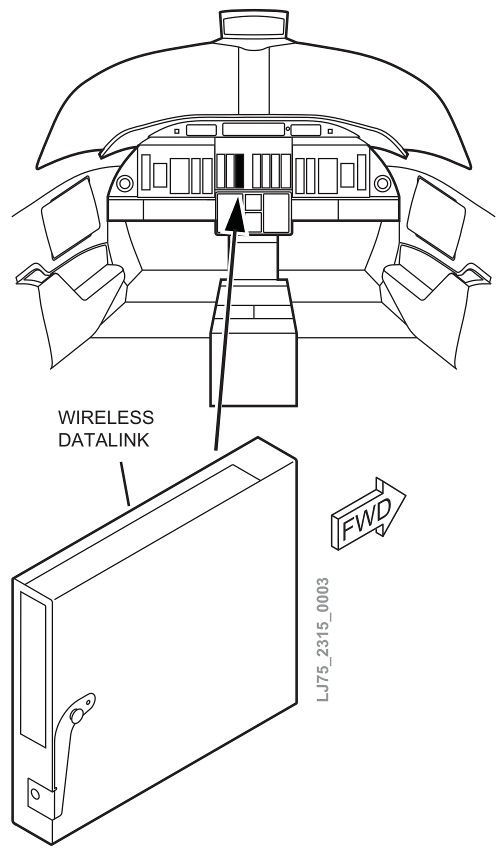


Fig. 27: Maintenance Data Recorder and Wireless Datalink Unit

SYSTEM OPERATION

Figures 28 and 29

Power for the Iridium SATCOM system is supplied through a circuit breaker on the left main bus on the pilot circuit breaker panel.

The operation of graphical weather is primarily controlled through the touch controllers (GTCs), but can be overlaid on the inset map via soft keys on the PFD.

Telephone screen shows the status of the Iridium satellite telephone connection and provides telephone controls. An aural alert is provided to indicate an incoming call is being received.

The transceiver interfaces with the maintenance data recorder and wireless datalink unit via RS232.

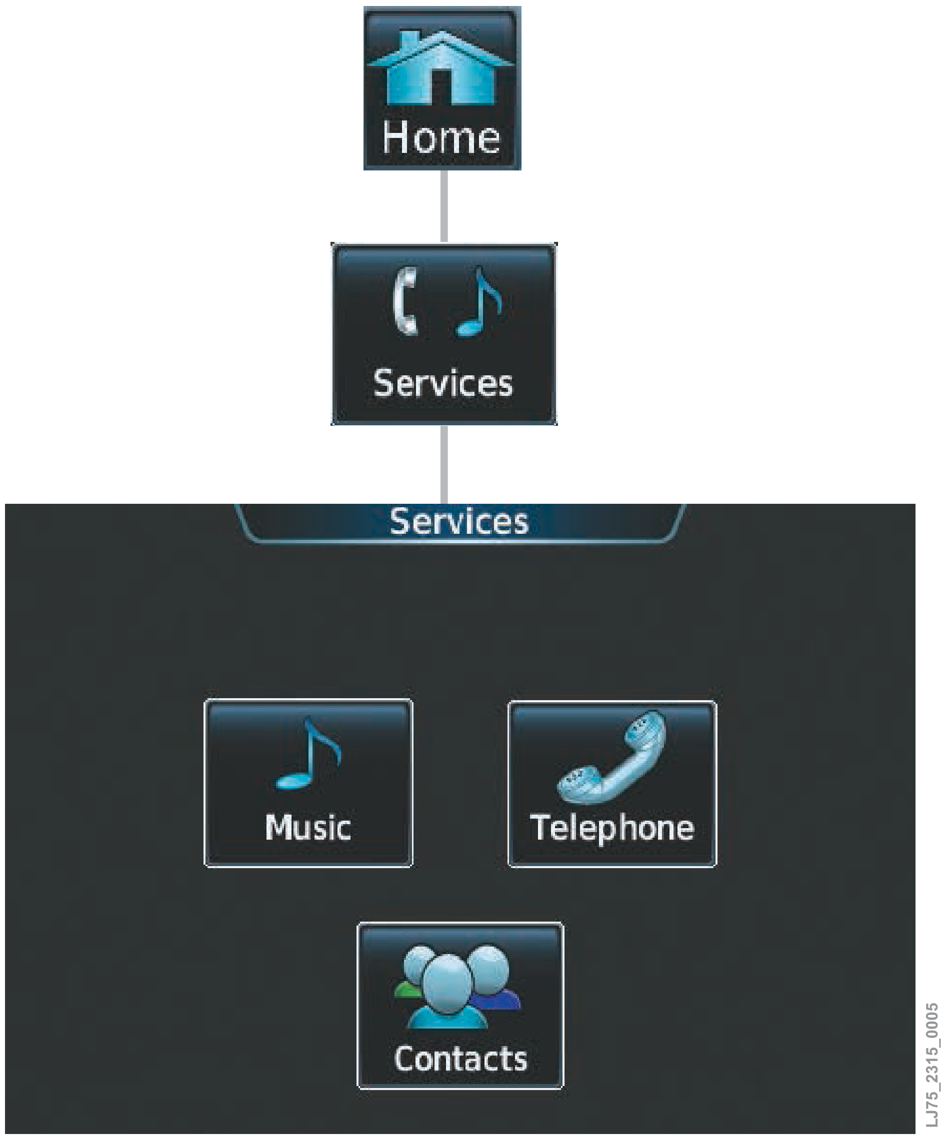


Fig. 28: Services Screen

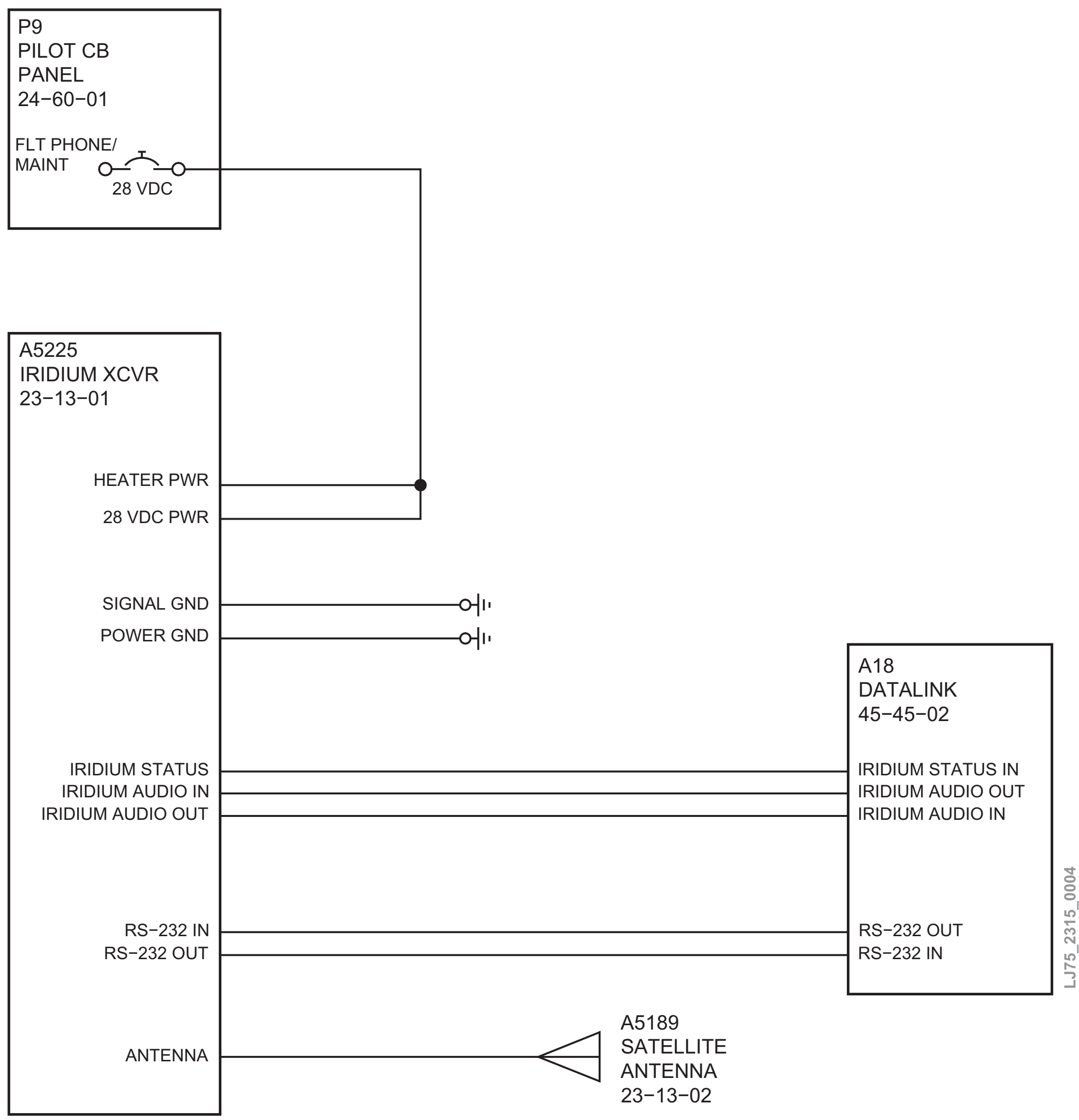


Fig. 29: Iridium SATCOM System Block Diagram

FAULT INDICATIONS

Table 2: Irdium Satcom System – CAS Messages

CAS MESSAGE	LOGIC
IRIDIUM FAIL	The GSR 56 has failed or is not registered.

SELCAL SYSTEM

(ATA 23-20-00)

OVERVIEW

The optional selective calling (SELCAL) system advises the flight crew that someone at a tuned ground station wants to communicate with them specifically. The SELCAL uses a four-letter code unique to each aircraft and provides aural and visual alerts when a SELCAL signal is received.

ASSOCIATED COMPONENTS

The SELCAL system consists of an integrated decoder function as part of the audio processor units 1 and 2.

The SELCAL system includes the following associated components:

- Audio processor units (2)
- GTC touch controllers (2)

COMPONENT DESCRIPTIONS

Audio Processor Units

Figure 30

The audio processor units 1 and 2 provide an interface between the integrated SELCAL decoder and GTC 1 and 2. The units also monitor the SELCAL line for an incoming signal.

The audio processor units 1 and 2 give an interface between the integrated SELCAL decoder and the GTC 1 and GTC 2. They also monitor the SELCAL line for an incoming signal. Audio processor unit 1 monitors the SELCAL signal from HF 1 and VH 1 and the audio processor unit 2 monitors the SELCAL signal from HF 2 and VHF 2. A failure of either audio processor unit causes a loss of the on-side HF radio for both pilot and copilot.

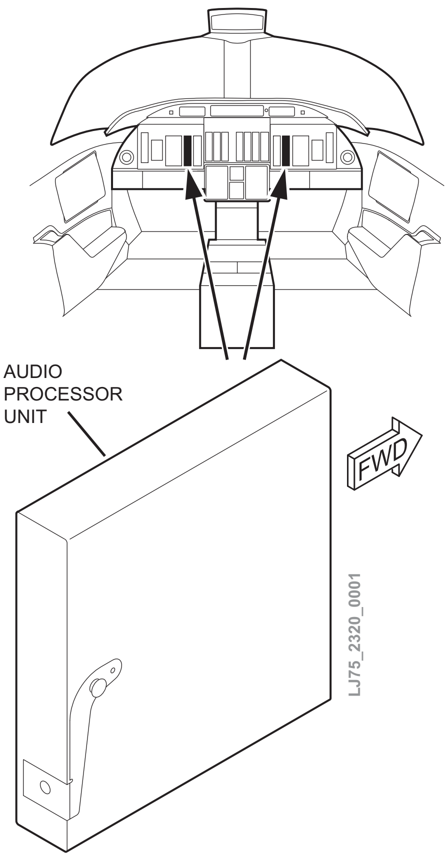


Fig. 30: Audio Processor Unit

GTC Touch Controllers

Figure 31

The SELCAL function is enabled and disabled via the touch controllers (GTC 1 and 2). The GTCs also provide the SELCAL code selection and display. They are also used to reset the SELCAL tone when received.

GTC 1 and GTC 2 are installed below the DU 2 on the tilt panel.

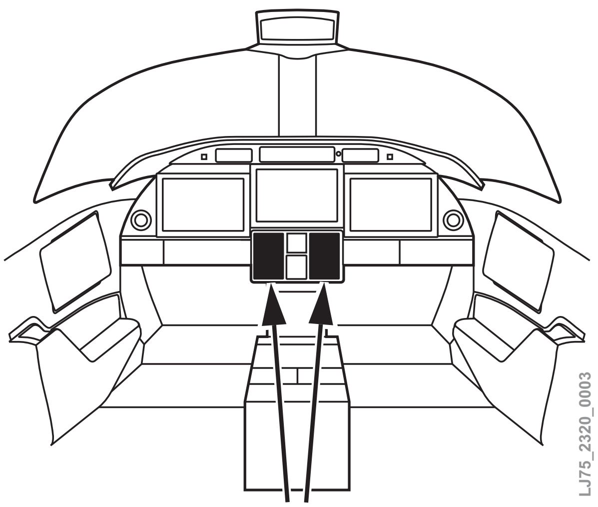


Fig. 31: Touch Controller

SYSTEM OPERATION CONTROLS AND INDICATIONS

Control and display of the SELCAL function is through the GTCs via the Audio and Radios page.

SELCAL Code Setup

The aircraft's unique SELCAL code is set by the manufacturer before aircraft delivery. The SELCAL four-letter code is entered on the GTCs via the SELCAL Code keyboard that is accessed through the Audio and Radios page. The SELCAL button must be pushed to officially set the code. A popup message also shows to confirm the SELCAL code is accepted.

SELCAL Signal Reception

The SELCAL call indication is placed in the appropriate COM radio identification window on the GTCs (VHF 1 or 2, HF 1 or 2) which received the call.

When a call is received, the GIA will play the aural SELCAL alert as well as the "SELCAL, SELCAL" aural audio message.

Refer to the HF communication system section (23-13-00) for more information on the HF system operation.

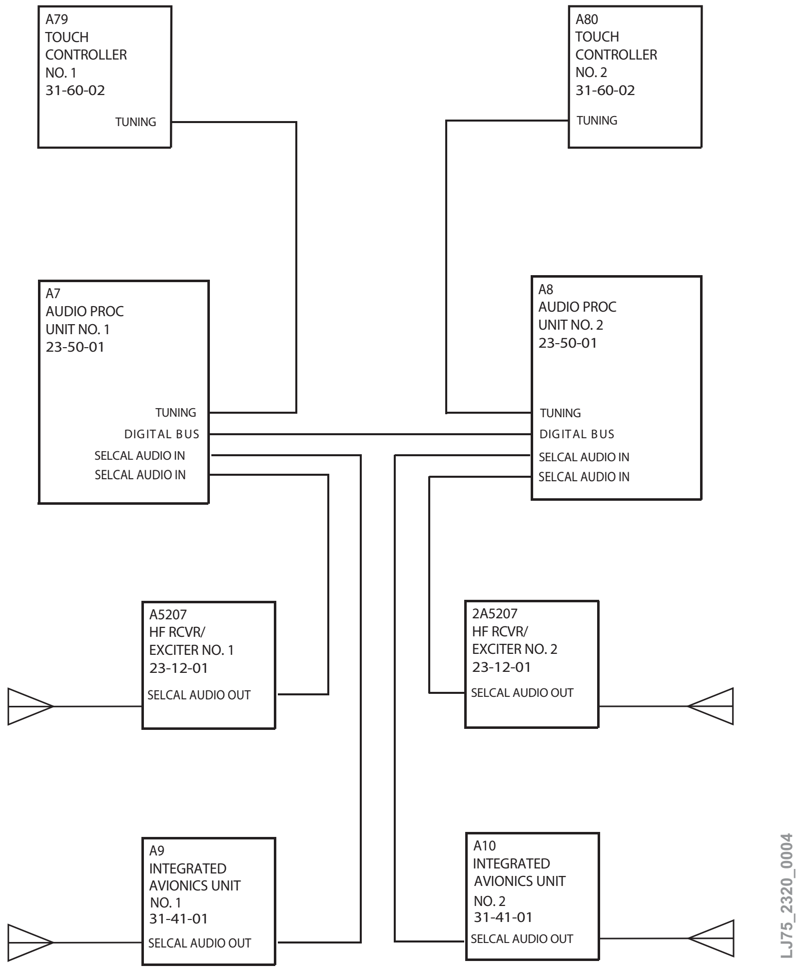
SYSTEM INTERFACES

Figure 32

Audio processor unit 1 is energized via the AUDIO 1 circuit breaker (through the cockpit miscellaneous P11 relay panel) from the left essential bus on the pilot CB panel. Audio processor unit 2 is energized via the AUDIO 2 circuit breaker (through the cockpit miscellaneous P11 relay panel) from the right essential bus on the copilot CB panel.

Touch controller 1 is energized via the GTC 1 circuit breaker from the emergency bus on the pilot CB panel.

Touch controller 2 is energized via the GTC 2 circuit breaker from the right essential bus on the copilot CB panel.



NOTE
1. SELCAL related connections shown only.

Fig. 32: SELCAL System Block Diagram

CONTROLLER-PILOT DATALINK COMMUNICATION

(ATA 23-25-00)

OVERVIEW

Figure 33

The optional controller-pilot datalink communication (CPDLC) system provides two-way datalink communication between the flight crew and air traffic controllers. This CPDLC system is Link 2000+ compliant and uses text message over VHF datalink communications. Link 2000+ is a requirement in Europe for all aircraft that fly above FL 285.

Voice communication channels become progressively congested and are supplemented by air-ground datalink communications. Because of the observed and expected increases in air traffic levels within Europe, parallel increases in air traffic control capacity are required to improve efficiency of communication between controllers and pilots.

The CPDLC includes four main services:

- Datalink initiation capability
- ATC communications management
- ATC clearances
- ATC microphone check

The services are available above 24,500 ft (7468 m). The communication via the CPDLC corresponds to phraseology used during ATC communication procedures and consists of a set of clearance, information, or request messages.

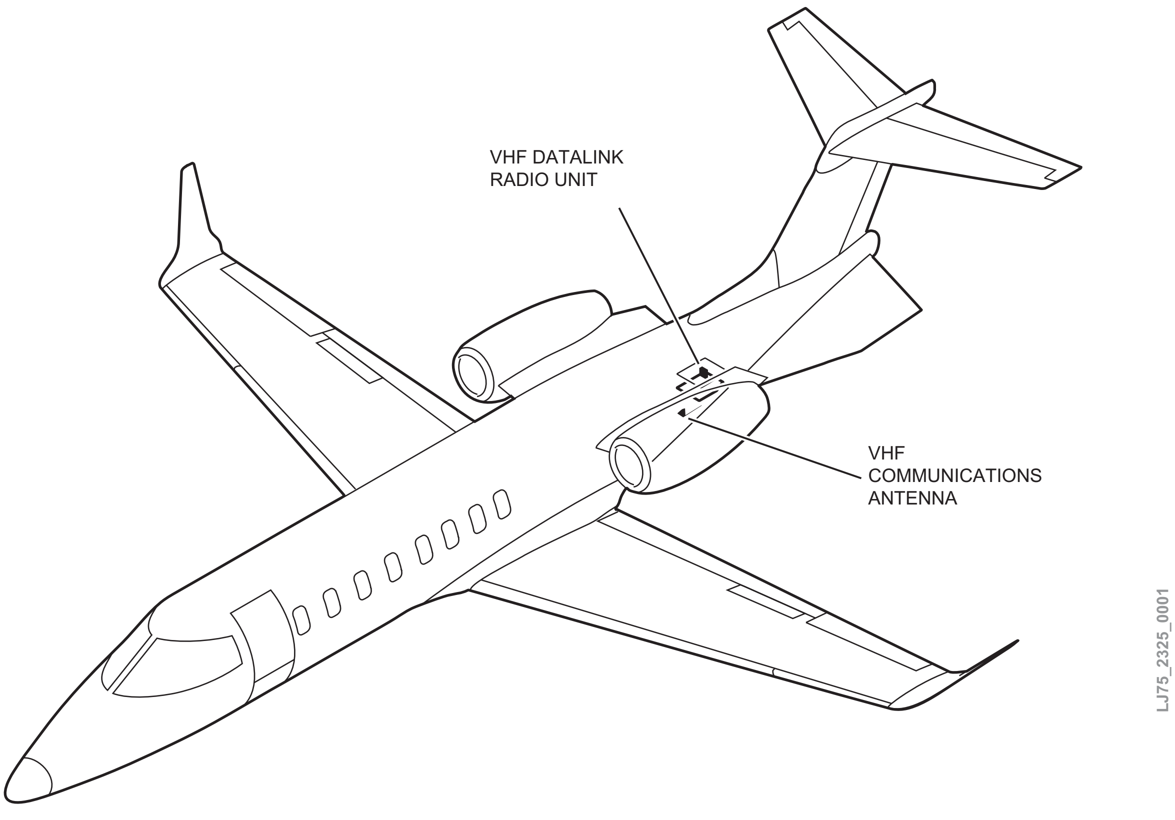


Fig. 33: CPDLC–Component Locator

COMPONENTS

The CPDLC includes the following component:

- VDL datalink radio unit (GDR 66)
- VHF datalink and COM 3 antenna

ASSOCIATED COMPONENTS

- Touch controllers (2)
- Display units (3)
- Integrated avionics units (2)
- Serial data concentrator units (2)
- #1 Audio processor unit

COMPONENTS DESCRIPTION

VDL Datalink Radio Unit

Figure 34

The VHF datalink radio is in the tailcone on the left side of aircraft centerline, and is accessed through the rear compartment door. The VHF datalink radio operates in the 117.975 to 137.000 MHz frequency band. It operates in a voice or datalink communication mode as follows:

- VHF datalink communication (VDL) mode using D8PSK modulation with a 31.5 kbps data rate and 25 kHz channel spacing. The VHF datalink radio is used for the modulation and demodulation of the air-ground VHF datalink (VDL) mode 2 signal.
- Voice communication mode using DSB-AM modulation with 8.33 and 25 kHz channel spacing.

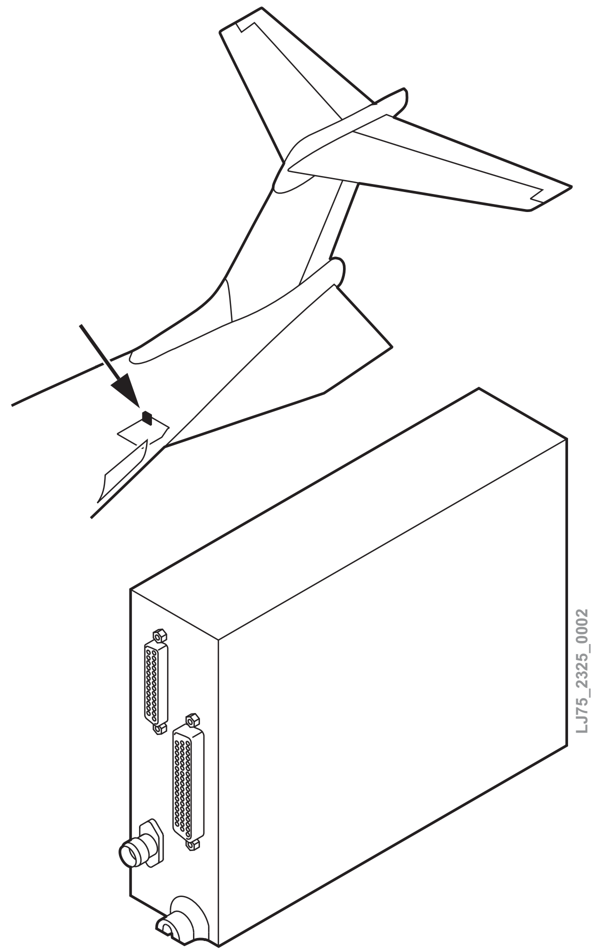


Fig. 34: VDL Datalink Radio Unit

VHF Datalink and COM 3 Antenna

Figure 33

The VHF datalink radio has a dedicated VHF antenna. The VHF datalink and COM 3 antenna is installed on bottom side of the fuselage at FS587.

ASSOCIATED COMPONENTS DESCRIPTION

GTC Touch Controllers

The GTC 1 and GTC 2 touchscreens give control and display through the CPDLC page when operating in datalink communications mode and at the Audio & Radios page when operating in COM3 voice mode. The CPDLC and Audio & Radios pages are accessed through at the GTC home page. Initialization fields and log-on requests are accessed through the CPDLC page.

Display Units

When operating in COM3 mode, DU1 and DU3 show the currently tuned active COM frequency. When operating in Datalink mode, DU1 and DU3 provide a ‘CPDLC’ annunciation to alert the crew of an incoming CPDLC message.

DU2 is dedicated to providing the Link 2000+ DLC CMU functions and is host to the higher level ATN functions and the CM and CPDLC applications. Only while operating in MFD will DU2 execute the Link 2000+ functions.

Integrated Avionics Units

The GIA provides Communications Management Unit functions and interfaces to the GDR 66 (indirectly via the GSD 41 data concentrators), processes the VDL Mode 2 protocol layers and hosts the Aeronautical Telecommunications Network (ATN) router.

The GIA also provides GPS information which is required to support the VDL Mode 2 protocol (position) as well as the CPDLC application (UTC). Only the #1 GIA will execute the Link 2000+ DLS functions.

Serial Data Concentrator Units

Both serial data concentrator units interface to the GDR 66 via serial RS-422 connection. Primary communications are through data concentrator 1, and data concentrator 2 provides a redundant communications path from the avionics to the GDR 66 radio in case of #1 concentrator fault.

#1 Audio Processor Units

The audio processor units are digital mixers that allow sending any combination of audio inputs to each audio output. When operating in COM3 voice mode, the GDR 66 sends COM3 audio to the #1 audio processor unit. Crew headset microphone audio is processed and sent to the GDR 66 through the #1 audio processor unit.

The audio processor unit 1 also hosts the SELCAL function and receives un-squelchedCOM3 audio from the GDR 66 on a dedicated analog input.

CPDLC SYSTEM CONTROLS AND DISPLAYS

The CPDLC system controls and displays are done through the GTCs via the CPDLC page.

Also, upon reception of a CPDLC message, a white “MESSAGE - See GTC” shows on the bottom right of the DUs. If the CPDLC page is not active on the GTC and a CPDLC message is received, a pop-up notification shows on the GTC to allow the flight crew one-touch access to the message(s).

Messages

Once a CPDLC message is received, an “Incoming Message” aural alert is generated. This aural warning is repetitive but suppressed during critical flight phases.

The “Incoming Message” aural alert is generated and prioritized by the integrated avionics unit and processed by the two audio processor units. Refer to the engine indication and crew alerting system (EICAS) section (31-52-00) for more details on the crew alerting system operation.

The CPDLC messages show with the following logic:

- Annunciation appears when a message is received
- Message requires flight crew response—Annunciation persists until response is sent
- Message does not require the flight crew response—Annunciation persists until crew reviews the message
- Message expires due to lack of crew response—Annunciation will clear
- Multiple messages received—Only one annunciation shows but it persists until all messages have been resolved or have timed out

CPDLC Status and Logon

Table 3

Before the flight crew has the ability to request a logon, an air-ground VDL mode 2 connection must already be established (i.e., “CPDLC: Connected” shows on the Status tab [Status page]). Also, if the VHF datalink radio is in voice mode, the flight crew is prompted to change it to the datalink mode.

The Status page shows the CPDLC connection status and identifies the current/next data authority facilities. Pushing the CONNECT softkey triggers the LOGON SETUP window which gives the flight crew the ability to enter the data needed by the ground facility to allow the aircraft to establish a logon and use the CPDLC.

The values provided by the flight crew must match the values on the filed flight plan or the logon will be rejected. If a logon fails, the “Link Status” display will reflect the failure.

Table 3 - CPDLC Annunciations

STATUS	ANNUNCIATION
UNSUCCESSFUL LOGON OR SUCCESSFUL LOGOFF	CPDLC: INHIBITED
ATC CONTACT	CURRENT FACILITY
DURING FLIGHT—AS INFO AVAILABLE	NEXT FACILITY

CPDLC Messages Tab

The CPDLC Messages tab shows when the CPDLC page is accessed after a CPDLC connection has been established. All messages show with relevant status icon (i.e., opened, unopened, reply, expired).

If a message text is longer than can be shown on the button for that message, an ellipsis (...) indicates that the message continues beyond the text shown. If the message storage capacity has been exceeded, the system will notify the crew and will begin purging the oldest message from the system memory. The message list is cleared at the end of flight. However, messages are not cleared if an in-air restart occurs.

Pushing a message or reply triggers the response page. This allows the user to either respond or review the response sent.

NOTE

An expired message can be read but cannot be replied to.

New Message Creation

Pushing the Create New Message button triggers a list of available downlink messages. Selecting a message triggers the relevant keyboard to allow the user to populate the required fields and create a message. Once the applicable fields have been populated, the message can be compiled or the user can concatenate a reason code. Once the concatenation has been added, the crew can compile the message and send it.

Message Response Pages

When a message is accessed from the Messages tab of the CPDLC page, the page shows the full message text and one of the following, depending on the situation:

- **Message response options—**If the message has not been previously answered, controls can select/send the appropriate response; after selecting a response, the GTC returns to the Messages tab of the CPDLC page
- **Message response—**If the message has been previously answered, the response shows; response options are not provided (i.e., the user cannot respond to a message that has been previously answered)
- **Expiration message—**Flight crew is notified if a message is expired; response options are not provided

Supported CPDLC Messages

Table 4

There are five types of messages/responses used in the CPDLC. They correspond to phraseology used by ATC procedures which consist of a set of clearance, information, or request messages.

Table 4 - CPDLC Message Examples

TYPE OF MESSAGE	MESSAGE	OPTIONS	RESPONSE
TYPE 1 (FIGURE 4)	ATC controller instructs flight crew to squawk transponder identification. Expired message: crew cannot respond.	WILCO UNABLE STANDBY	WILCO: Screen shows crew selection, crew can review, then send or discard. UNABLE: Reason can be concatenated STANDBY: Crew acknowledges message but unable to address the message at present time; resets the message timer, giving crew additional time to reply before message expires.
TYPE 2 (FIGURE 5)	ATC controller sends a “free text” message. Expired message: crew cannot respond.	AFFIRM STANDBY	AFFIRM: Screen shows crew selection, crew can review, then send or discard. STANDBY: Crew acknowledges message but unable to address the message at present time; resets the message timer, giving crew additional time to reply before message expires.
TYPE 3 (FIGURE 6)	ATC controller sends a CPDLC message to tell crew there is no speed restriction. Expired message: crew cannot respond.	ROGER STANDBY	ROGER: Screen shows crew selection, crew can review, then send or discard. STANDBY: Crew acknowledges message but unable to address the message at present time; resets the message timer, giving crew additional time to reply before message expires.
TYPE 4 (FIGURE 7)	Crew must reply with allowable response. Expired message: crew cannot respond.	CAN ACCEPT STANDBY	CAN ACCEPT: Screen shows available selections, crew can add variables to the CPDLC message, crew can review, then send or discard. STANDBY: Crew acknowledges message but unable to address the message at present time; resets the message timer, giving crew additional time to reply before message expires.
TYPE 5 (FIGURE 8)	Crew is advised to CHECK STUCK MICROPHONE ON 125.250 MHZ. No response required or available.	N/A	N/A

ATC Microphone Check

The CPDLC can ask all aircraft in the vicinity to check that they are not blocking a voice channel. (Refer to type 5 message).

Cockpit Voice Recorder Interface

The CVR records CPDLC messages and voice data for 120 minutes. Datalink information is provided via the serial data concentrator unit 1 through an ARINC 429 data bus. Refer to the cockpit voice recorder system section (23-70-00) for more details on the CVR system operation.

SYSTEM OPERATION

Figure 35

The VHF datalink (VDL) CPDLC radio is energized via the COMM 3/CPDLC circuit breaker from the right main avionics bus on the copilot CB panel.

Touch controller GTC 1 is energized via the GTC 1 circuit breaker from the left essential bus on the pilot CB panel. Touch controller GTC 2 is energized via the GTC 2 circuit breaker from the right essential bus on the copilot CB panel.

Display unit DU 1 is energized via the DU 1 circuit breaker from the emergency battery bus on the pilot CB panel. Display unit DU 2 is energized via the DU 2 circuit breaker from the left essential avionics bus on the pilot CB panel. Display unit DU 3 is energized via the DU 3 circuit breaker from the right essential avionics bus on the copilot CB panel.

Integrated avionics unit 1 is energized via the GIA COMM 1 PRI circuit breaker (through the cockpit miscellaneous P11 relay panel) from the left essential bus on the pilot CB panel. It is also energized via the GIA COMM 1 SEC circuit breaker from the right main avionics bus on the copilot CB panel. Integrated avionics unit 2 is energized via the GIA COMM 2 circuit breaker from the right essential bus on the copilot CB panel.

Serial data concentrator unit 1 is energized via the L DATA/DATA 1 circuit breaker from the left essential bus on the pilot CB panel. Serial data concentrator unit 2 is energized via the R DATA/DATA 2 circuit breaker from the right essential bus on the copilot CB panel.

Audio processor unit 1 is energized via the AUDIO 1 circuit breaker (through the cockpit miscellaneous P11 relay panel) from the left essential bus on the pilot CB panel. Audio processor unit 2 is energized via the AUDIO 2 circuit breaker (through the cockpit miscellaneous P11 relay panel) from the right essential bus on the copilot CB panel.

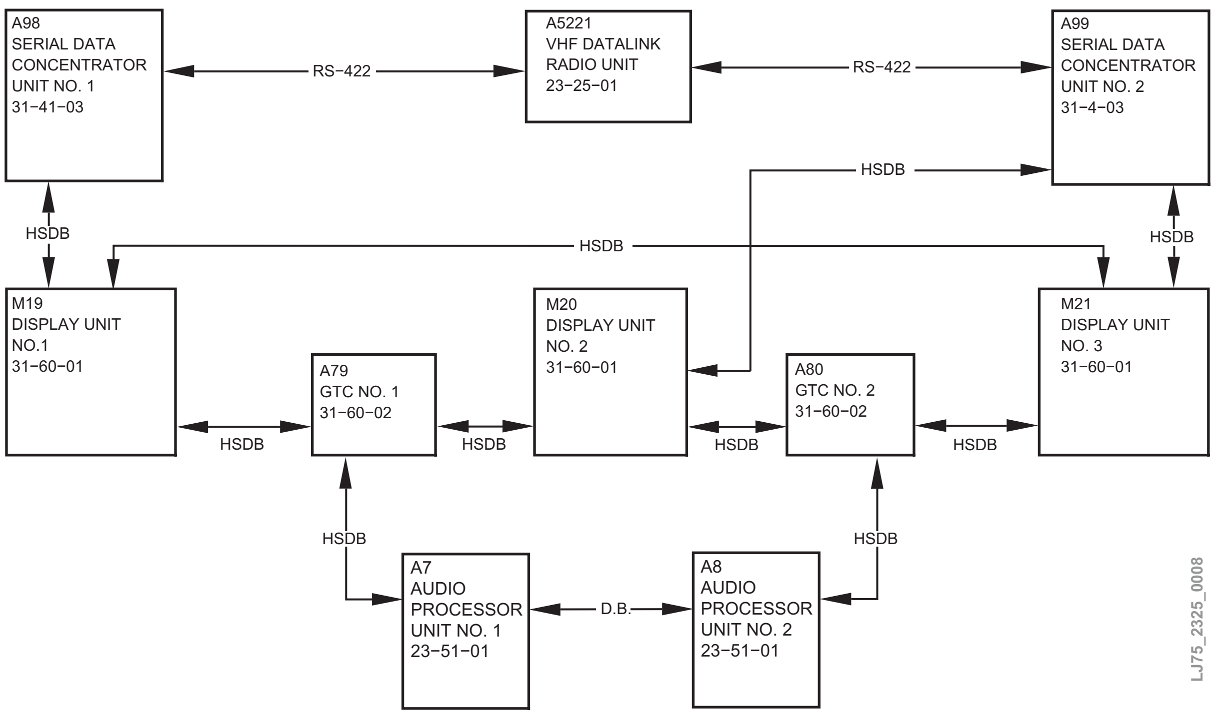


Fig. 35: CPDLC–Component Locator Diagram

This page intentionally left blank

PASSENGER ADDRESS SYSTEM

(ATA 23-30-00)

OVERVIEW

The passenger address system is used by the flight crew to speak to the passengers. Voice communication is provided by the audio system through the passenger speakers.

Signal communication is provided by audible chimes when the NO SMOKING/BELTS switch is on.

ASSOCIATED COMPONENTS

- NO SMOKING/BELTS switch
- Audio processor units (2)
- Touch controllers (GTCs) (2)
- Cabin management system

COMPONENT DESCRIPTION AND OPERATION

Passenger Speakers

Figure 36

The "invisible" speaker system is installed in the cabin. It consists of modern technology that uses transducers that are integrated into the window panels. Each Transducer consists of an Exciter, Hood, and Mount. The Exciter is installed on the panel using the Mount. The Hood covers the Exciter to prevent interference between it and other materials (i.e. insulation).

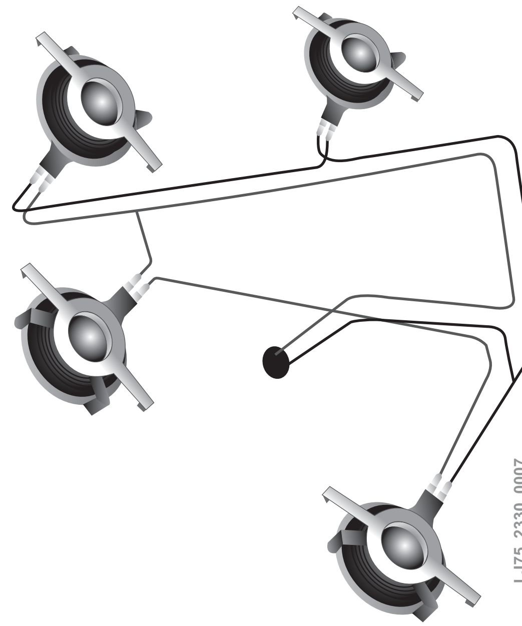


Fig. 36: Invisible Speaker System

Touch Controller (GTC)

The touch controllers are used to control the audio volume for the passenger address system during aircraft on ground and in the air.

NO SMKG/BELTS Switch

Figure 37

The NO SMKG/BELTS switch is located on the overhead switch panel.

Setting the switch to BELTS or NO SMKG/BELTS provides a chime and annunciation to the cabin management system via speakers in the cabin and the cabin headphones.

Fig. 37: NO SMKG/BELTS Switch

Audio Processor Units

Even though the analog audio signals from the VHF datalink radio are connected to audio processor unit 1 only, audio processor unit 2 is considered a backup function. The audio processor units are digital mixers that send any combination of audio inputs to each audio output. Each audio processor unit communicates with its onside GTC via the HSDB. As a backup control path, it also communicates with its cross-side integrated avionics unit via a RS-232 data bus.

Audio processor units 1 and 2 are installed forward of display units DU 1 and DU 2. Audio processor unit 1 is installed forward of DU 1. Audio processor unit 2 is installed forward of DU 2.

Cabin Management System

The Learjet 70/75 is equipped with the Lufthansa Technik nice HD cabin management system. The passenger address system is integrated with the cabin management system.

Refer to the aircraft CMM for details on this system.

SYSTEM OPERATION

A passenger address system is available for delivering voice messages over the cabin speaker. When the PA Button is selected on the Touchscreen Controller, the MIC Annunciator is replaced with a green PA, and the active COM frequency changes to white, indicating that there is no COM selected. The active COM frequency on the PFD is replaced by a white PA annunciation. A Push-to-Talk (PTT) must be pressed to deliver PA announcements. The PA Annunciator flashes about once per second while the PTT is depressed.

This page intentionally left blank

AUDIO INTEGRATING SYSTEM

(ATA 23-50-00)

OVERVIEW

The audio integrating system uses the communication functions within the integrated avionics units, audio processors, and touch controllers (GTCs). The system allows the flight crew to manage headset audio, microphones, cockpit speakers, the intercom, and the passenger address system.

The controls include source and microphone selection, volume control, squelch, and intercom. The controls for audio and radios are co-located for a more intuitive user interface.

COMPONENTS

The audio integrating system consists of:

- Audio processors (2)
- Cockpit speakers (2)

ASSOCIATED COMPONENTS

- Integrated avionics units (2)
- GTC touch controllers

COMPONENT DESCRIPTION AND OPERATION

Audio Processors

Figure 38

The audio processor unit processes audio signals as well as interfaces to all audio signal sources and destinations. Each unit integrates NAV/COM digital audio, intercom system, and marker beacon functions. Each unit communicates with its onside GTC via the HSDB and its cross-side integrated avionics unit via the RS-232 as a backup control path.

The audio processor 1 provides an interface to the pilot headset, and the audio processor 2 provides the interface to the copilot headset. The two audio processors unit 36 share audio signals as necessary on a direct connection via a digital audio bus.

The audio processor unit 36 utilizes digital audio technology, which allows mixing of audio from various sources. The audio processor unit interfaces include COM radios, NAV radios, as well as prioritized and mixed aural alerting.

Integrated Avionics Units

Figure 38

Each integrated avionics unit contains VHF COM/NAV/GS receivers. Each unit is paired with the onside PFD via a high-speed databus (HSDB) connection. The units communicate directly with each other via the CAN protocol only if a system data path failure occurs.

Cockpit Speakers

Figure 38

Two cockpit speakers are installed in the overhead panels of the flight deck.

GTC Touch Controllers

Figure 38

Two GTCs provide control of the audio and display status of the audio settings.

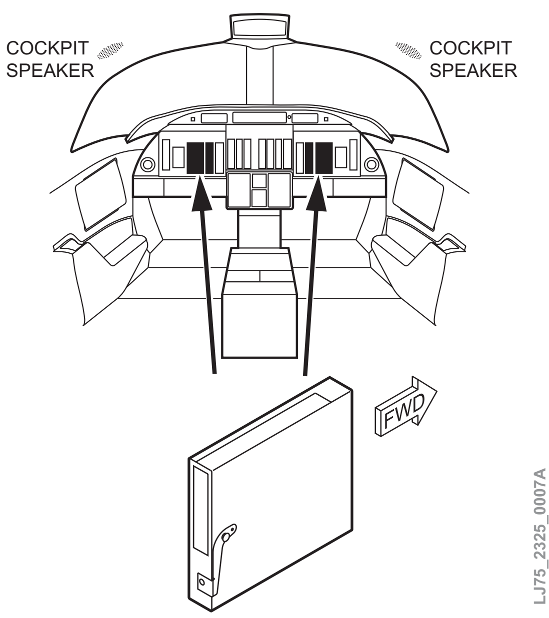


Fig. 38: Audio Processor Units

SYSTEM OPERATION

Figure 39

The pilot oxygen mask microphone is controlled by the L OXY MIC switch on the left instrument panel. The copilot oxygen mask microphone is controlled by the R OXY MIC switch on the right instrument panel.

Pressing the emergency communication (EMER) switch directly connects the onside microphone to the designated emergency VHF communications transmitter and directly connects the received audio signals from the EMER VHF communication and navigation receivers to the onside headphones.

All electronic circuitry is eliminated in the EMER position. The EMER mode disables all other audio panel modes with the exception of the headphone level which is controlled by the headphone control. Cockpit voice recorder output is available as long as electrical power is applied to the audio panel.

The GTC is the user interface for controlling the audio and display status of the audio settings. The left GTC controls the pilot audio settings, and the right GTC controls the copilot audio settings. If a GTC fails, both sides can be controlled by the remaining GTC.

The active frequencies for COM1 and 2 are displayed on the PFDs. An active COM frequency displayed in green indicates that the COM transceiver is selected on the onside audio processor. During COM transmission, a white TX appears by the active COM frequency on the GTC and PFD. During COM signal reception, a white RX appears by the active COM frequency on the GTC and PFD. When the same COM radio is selected on both audio panels, the pilot has transmit priority on COM1 and the copilot has transmit priority on COM2.

The audio integrating system is capable of auto-tuning a COM frequency from the GTC waypoint and nearest options. For example, the nearest airport feature provides an option to load the published frequencies as the active or standby frequency. The COM radios can tune either 25-kHz spacing (118.000 to 136.975 MHz) or 8.33-kHz spacing (118.000 to 136.990 MHz) for 760-channel or 3040-channel configuration. When 8.33-kHz channel spacing is selected, all of the 25-kHz channel spacing frequencies are also available in the complete 3040-channel list.

Automatic squelch quiets unwanted static noise when no audio signal is received, while still providing good sensitivity to weak COM signals. When automatic squelch is disabled, COM audio reception is always on. Continuous static noise is heard over the headsets and speaker, if selected. When automatic squelch is disabled, a white SQ appears next to the COM frequency on the GTCs and PFDs.squelch is disabled, a white SQ appears next to the COM frequency on the GTCs and PFDs.

Power

The audio processor 2 is powered by the AUDIO 2 circuit breaker on the right essential bus located on the copilot circuit breaker panel.

The audio processor 1 is powered by the AUDIO 1 circuit breaker on the left essential bus located on the pilot circuit breaker panel.

The primary power for the audio function of the integrated avionics unit 1 is powered by the GIA 1 COM PRI circuit breaker on the left essential bus on the pilots circuit breaker panel.

The secondary power for the audio function of the integrated avionics unit 1 is powered by the GIA 1 COM SEC circuit breaker on the right main avionics bus on the copilot circuit breaker panel.

Power for the audio function of the integrated avionics unit 2 is supplied by the GIA 2 COM circuit breaker on the right essential bus on the copilot circuit breaker panel.

FAULT INDICATIONS

Table 5: Audio Integrating System – CAS Messages

CAS MESSAGE	LOGIC
AUDIO 1 FAULT	At least one of the GMA 1 system messages have been triggered.
AUDIO 2 FAULT	At least one of the GMA 2 system messages have been triggered.
AUDIO 1/2 FAULT	At least one of the GMA 1/2 system messages have been triggered.
L SPEAKER OFF	The left speaker has been selected OFF on the GTC.
R SPEAKER OFF	The right speaker has been selected OFF on the GTC.
LR SPEAKER OFF	The left/right speakers have been selected OFF on the GTC.

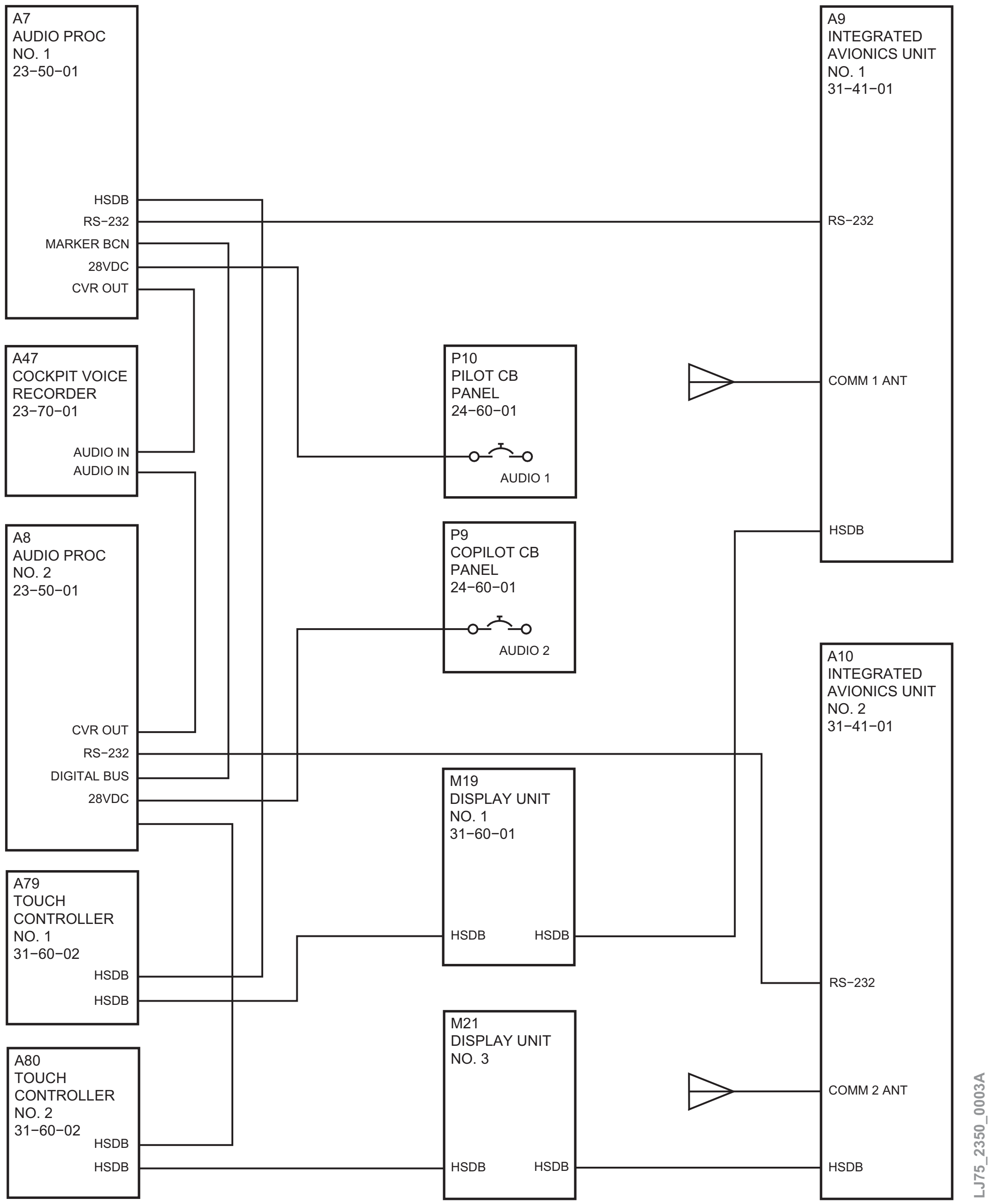


Fig. 39: Audio Integrating System Block Diagram

This page intentionally left blank

STATIC DISCHARGING SYSTEM

(ATA 23-60-00)

OVERVIEW

The static discharging system is a group of static dischargers on the airframe. The dischargers are installed on various aircraft trailing-edge extremities to allow gradual bleed off of static electricity from the airframe with a minimum amount of radio interference.

COMPONENTS

- Static dischargers (19)

COMPONENT DESCRIPTION AND OPERATION

Static Dischargers

Each static discharger assembly has two parts: the discharger and the mounting base. The mounting base is part of the aircraft structure. The discharger can be replaced without removing the base.

The discharger is a resistive graphite-coated rod of aligned fibers, tapered toward the tip. This design allows flexibility and graded resistance, which has a noise-quieting quality. The discharger also has a heat-shrunk sheath for additional protection. The discharger tip is a small brush of nichrome wires to give high-current capability.

SYSTEM OPERATION

Figure 40

Flight through precipitation, electric fields, and engine-produced ionization builds up electrostatic charges on the aircraft. When the aircraft is flying at speeds of 120 to 600 kt, these charges can generate radio frequency noise which disrupts reception on communication and navigation systems. As the aircraft charge builds up, the charge leaks off the aircraft, generating radio frequency noise. This interferes with aircraft radio equipment (ADF, HF, VHF, VOR, etc.). Static dischargers prevent the aircraft from building up the static potential to interfere with radio operations.

The dischargers are installed as follows:

- Top of the vertical stabilizer (1)
- Each elevator (6)
- Each delta fin (4)
- Wing (3 on each winglet and 1 immediately inboard of each winglet) (8)

Visual inspection for burns or lightning damage and general condition is required before takeoff and after landing.

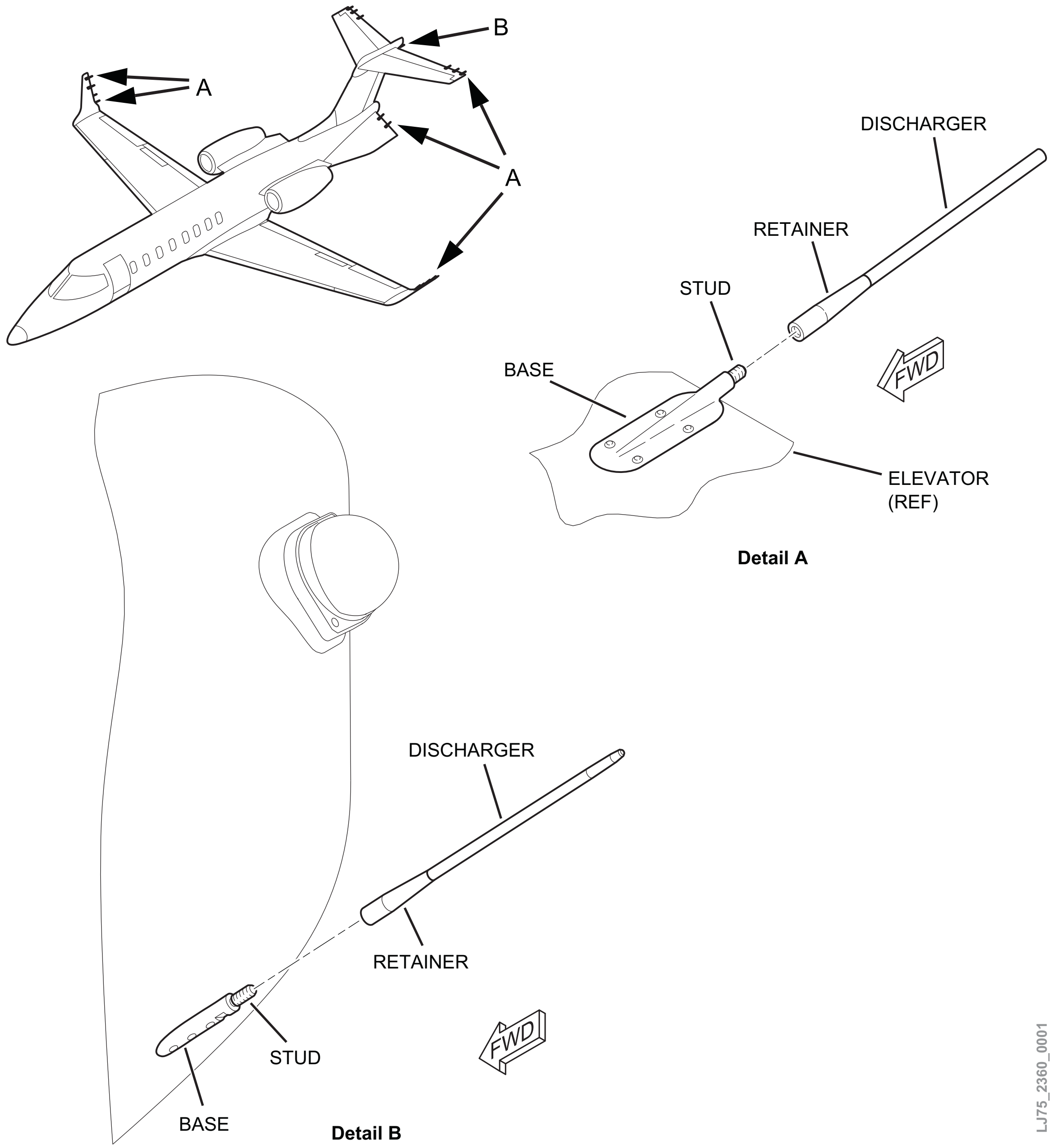


Fig. 40: Static Dischargers

COCKPIT VOICE RECORDER SYSTEM

(ATA 23-70-00)

OVERVIEW

The cockpit voice recorder (CVR) system provides continuous audio recording up to 120 minutes. All audio input signals, the cockpit sounds from an area microphone, and additional voice inputs from the microphone are recorded.

When the optional third communications radio is installed, the CVR will also record CPDLC messages.

COMPONENTS

Figure 41

The cockpit voice recorder (CVR) system consists of:

- Cockpit voice recorder
- CVR control panel
- Area microphone
- CVR preamplifier
- Inertial switch

Associated Components

- Audio processor units (2)
- Underwater loactor beacon (ULB)

The underwater locator beacon (ULB) is located on one end of the CVR. For more information on the ULB, refer to 25-61-00.

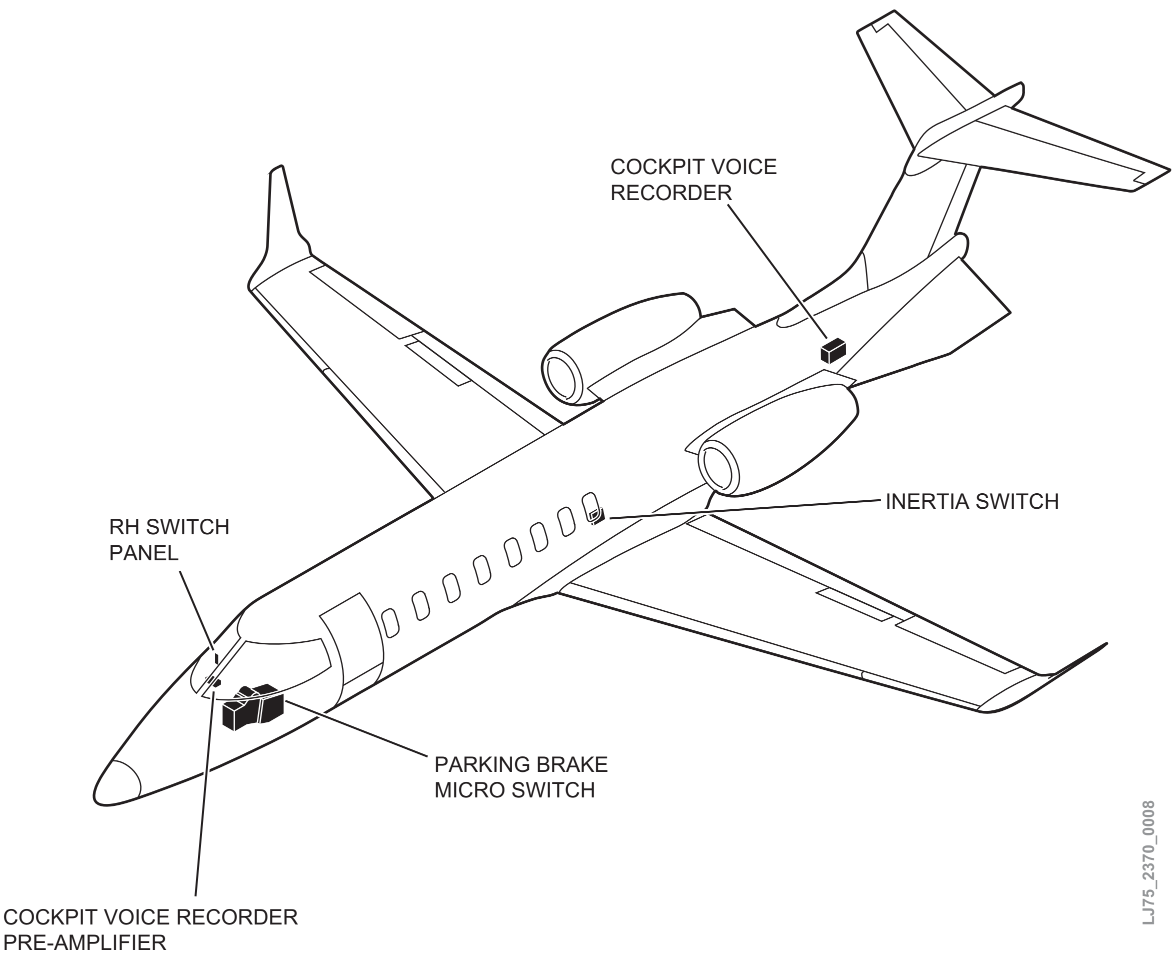


Fig. 41: Cockpit Voice Recorder Component Locator

COMPONENT DESCRIPTION AND OPERATION

Cockpit Voice Recorder

Figure 42

The CVR is a crash-survivable recording device that simultaneously records narrow-band voice channels and flight crew audio control units. The CVR records one wide-band area channel cockpit area microphone.

The CVR is painted bright international orange with reflective tape. The CVR is located in the tailcone.

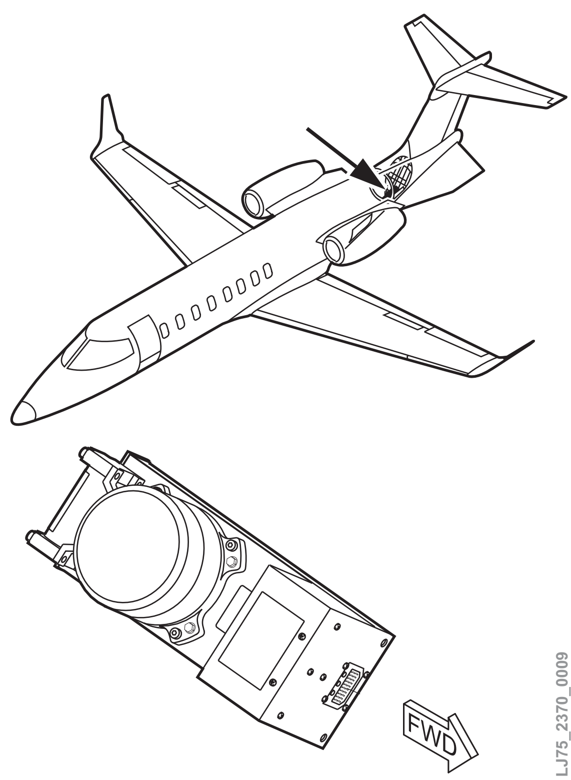


Fig. 42: CVR

Control Panel

Figure 43

The control panel consists of a CVR ERASE button and a monitor headphone jack. The control panel is on the right switch panel.

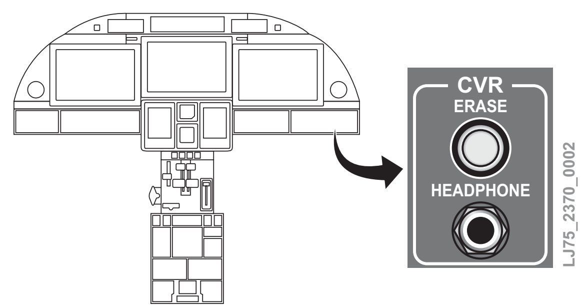


Fig. 43: CVR Control Panel

Area Microphone

Figure 44

The area microphone records wide-band area audio from the cockpit and surrounding area into crash-survivable memory. The area microphone is on the glareshield.

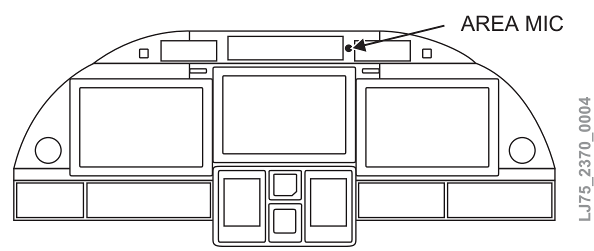


Fig. 44: Area Microphone

CVR Preamplifier

Figure 45

The CVR pre-amplifier amplifies the microphone signals before they pass to the CVR. The CVR pre-amplifier is located in the glareshield facia panel.

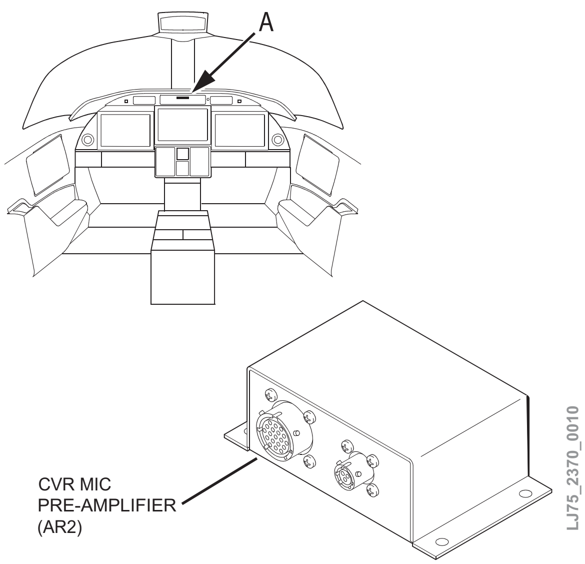


Fig. 45: Cockpit Voice Recorder Preamplifier

Inertia Switch

Figure 46

The inertia switch provides an automatic means to simultaneously stop the recorder and prevent erasure from functioning after a crash.

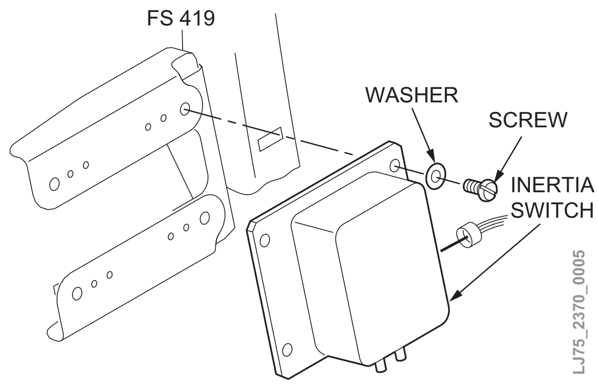


Fig. 46: Inertia Switch

Audio Processor Units

The GMA 36 audio processor unit provides audio output to the CVR. All the communications received and transmitted by the audio system are routed to the CVR. The audio played on the headphones of the on-side crew member is made available on a dedicated pin. The audio from pilot side is provided by GMA 1 and copilot side by GMA 2. The CVR receives these analog audio channels and saves them as required. This audio output from the GMA remains functional in the Failsafe mode as well. The CVR will thus receive crew audio even in case of GMA failure.

SYSTEM OPERATION

Figure 47

Electrical Power Application

When electrical power is applied to the pilot CB panel and the CVR circuit breaker is depressed, the CVR system initiates a built-in test (BIT) to determine the integrity of the system. If a failure is detected, the failure condition is stored in crash-protected memory, the CVR front BITE indicator is continuously activated, and a CVR fault signal is sent to data concentrator unit no. 1 for subsequent display on the EICAS.

Record, Test, and Status Monitor

The record, test, and status function stores cockpit audio, audio control unit communications, and timing to the crash survivable memory. This function also stores additional data such as configuration data, memory start/stop pointers, BIT data, elapsed time indicator (ETI), error logging data, and repair history. A background test is also performed to verify correct operation of the CVR. If a failure is detected, the CVR front panel BITE indicator is continuously activated and a CVR fault signal is sent to data concentrator unit no. 1 for subsequent display on the EICAS. For more information on the EICAS system, refer to 31-51-00.

Push-To-Erase Function

The push-to-erase function is initiated by pressing the erase button. The aircraft must be on the ground with the parking brake set to initiate the erase process. A switch, mounted on the emergency/parking brake handle assembly, completes a circuit to erase the CVR. When the erase process is completed, a 3-second 400-Hz tone is sent to the monitor headphones.

Loss or Removal of Electrical Power

When loss or removal of electrical power occurs, the CVR enters the power-down function. While recording continues during the power-down function, if electrical power is interrupted for more than 200 milliseconds, “housekeeping” tasks are performed to provide a graceful power-down sequence.

The “housekeeping” tasks send pointers and buffered data to crash-survivable memory. If electrical power is recovered after 200 milliseconds but before a hardware reset is issued, the record function is re-activated. If electrical power does not recover, recording will cease until power is applied again.

Cessation of Recording

The G-activated inertia switch is installed in series with the CVR circuit breaker. If the aircraft is involved in a crash, the inertia switch removes electrical power from the CVR system and prevents information from being erased.

FAULT INDICATIONS

Table 6: Cockpit Voice Recorder System – CAS Messages

CAS MESSAGE	LOGIC
CVR FAIL	The cockpit voice recorder has failed it’s internal test or has lost power.

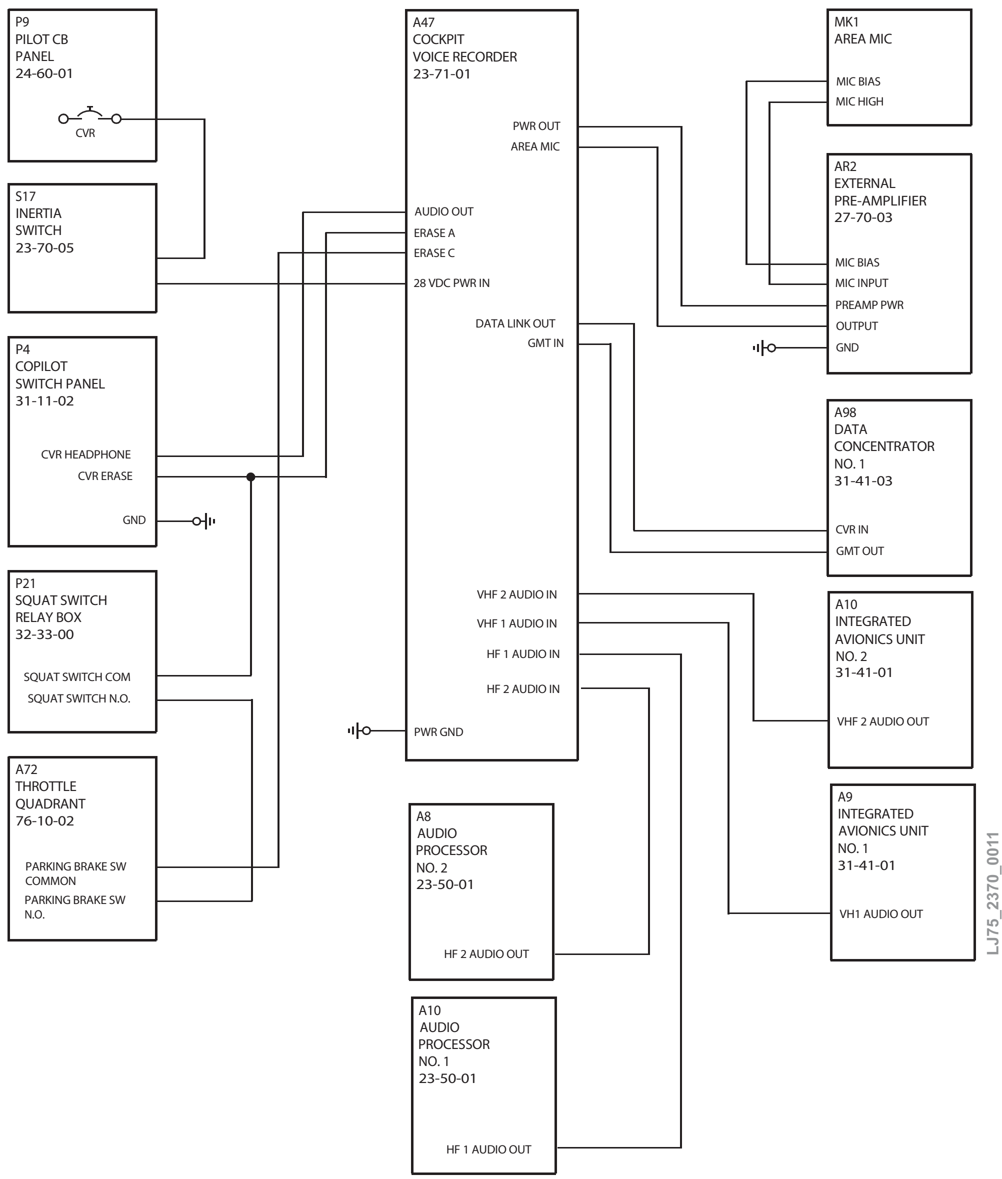


Fig. 47: Cockpit Voice Recorder Block Diagram

This page intentionally left blank

TABLE OF CONTENTS

EQUIPMENT AND FURNISHINGS
(ATA 25-00-00)
INTRODUCTION 1

FLIGHT COMPARTMENT
(ATA 25-10-00)
OVERVIEW 3
COMPONENTS 3
COMPONENT DESCRIPTION AND OPERATION 3
Overhead Panels 3
Upper Sidewalls 3
Lower Sidewalls 3
Kick Panels 4
Floor Covering 4
Rudder Pedal Shroud 4
Glareshield 4
Center Post Cover 4
Eye Reference Locator 4
Cockpit Speakers 4
Cockpit Curtain 4
Control Wheel Cover Plate 4
Certificate Holder 7
Drink Holders 7
Crew Seats 7

PASSENGER COMPARTMENT
(ATA 25-20-00)
OVERVIEW 9
COMPONENTS 9
COMPONENT DESCRIPTION AND OPERATION 9
Passenger Cabin Headliner 9
Convenience Panels 9
Upper Sidewall Panels 9
Window Shade Assemblies 10
Emergency Exit Door Closeout 10
Executive Table 10
Armrest Caps 10
Lower Sidewall Panels 10

Kick Panels 10
Floor Covering 10
Passenger/Crew Door Closeout 10
Passenger/Crew Door Stairs Covering 10
Passenger Seats 11
Passenger Restraint Belts 11

GALLEY
(ATA 25-30-00)
OVERVIEW 13
COMPONENTS 13
COMPONENT DESCRIPTION AND OPERATION 13
Galley 13
Galley Headliner 13
SYSTEM OPERATION 13

LAVATORY
(ATA 25-40-00)
OVERVIEW 15
COMPONENTS 15
COMPONENT DESCRIPTION AND OPERATION 16
Aft Cabin Partition 16
Contact Pad 16
Lavatory Headliner 16
Convenience Panels 16
Lavatory Upper Sidewalls 16
Lavatory Lower Sidewalls 16
Lavatory Floor Covering 16
Lavatory Toilet Shroud 16
Lavatory Vanity 16

CARGO COMPARTMENT
(ATA 25-50-00)
OVERVIEW 19
COMPONENTS 19
COMPONENT DESCRIPTION AND OPERATION 19
Left Forward Cabinet 19
Right Forward Closet 19
Lavatory Stowage Retention Net 19

Lavatory Stowage Coat Rod ... 19
Baggage Compartment ... 20
Baggage Compartment Vent Valves ... 20
Baggage Compartment Cargo Restraining Net ... 20

EMERGENCY EQUIPMENT
(ATA 25-60-00)
OVERVIEW ... 23
COMPONENTS ... 23
COMPONENT DESCRIPTION AND OPERATION ... 23
Life Vests ... 23
Smoke Goggles ... 23
Flashlight ... 24
Information Cards ... 24

UNDERWATER LOCATOR BEACON
(ATA 25-61-00)
OVERVIEW ... 27
SYSTEM OPERATION ... 27

EMERGENCY LOCATOR
(ATA 25-62-00)
OVERVIEW ... 29
COMPONENTS ... 30
Associated Components ... 30
COMPONENTS DESCRIPTION ... 30
Emergency Locator Transmitter (ELT) ... 30
Emergency Locator Antenna ... 31
ELT Switch ... 31
Emergency Locator Buzzer ... 31
SYSTEM OPERATION ... 32
ELT Operating Modes ... 32
Programming ... 32
Registration ... 32
Battery Replacement ... 33
System Interface ... 33
System Monitoring ... 34
FAULT INDICATION ... 34
System Test ... 34

INSULATION
(ATA 25-80-00)
OVERVIEW 35
COMPONENTS 35
COMPONENT DESCRIPTION AND LOCATION 35
Bagged Thermal Insulation 35
Acoustic Insulation 35

EQUIPMENT AND FURNISHINGS

(ATA 25-00-00)

INTRODUCTION

Equipment and furnishings consist of the items mounted in the aircraft or contained in the flight, passenger, and cargo compartments, as well as items carried for emergencies.

Materials used in the repair and/or refurbishment of the aircraft interior or baggage compartments must comply with applicable Federal Aviation Regulations.

The following sections are included in this chapter:

- Miscellaneous Equipment Flight Compartment — ATA 25-10-00
- Miscellaneous Equipment Passenger Compartment — ATA 25-20-00
- Galley Area — ATA 25-30-00
- Lavatory Area — ATA 25-40-00
- Cargo Compartment — ATA 25-50-00
- Emergency Equipment — ATA 25-60-00
- ELT — ATA 25-62-00
- Thermal Insulation — ATA 25-80-00

This page intentionally left blank

FLIGHT COMPARTMENT

(ATA 25-10-00)

OVERVIEW

The flight compartment is separated from the passenger compartment by a curtain, left cabinet, and right closet. A service and stowage compartment is located outboard of the pilot and copilot seats.

COMPONENTS

The following components are installed in the flight compartment (quantities vary due to interior completion options):

- Overhead panels
- Upper sidewalls
- Lower sidewalls
- Kick panels
- Floor covering
- Rudder pedal shroud
- Glareshield
- Center post cover
- Eye reference locator
- Cockpit speakers
- Cockpit curtain
- Control wheel cover plate
- Certificate holder
- Drink holders
- Crew seats

COMPONENT DESCRIPTION AND OPERATION

Overhead Panels

Figure 1

The overhead panels provide a finished ceiling in the cockpit. Overhead panels contain cockpit speakers, overhead lighting, and air gaspers.

Upper Sidewalls

Figure 1

The upper sidewalls cover the cockpit area between the lower and overhead panels below and aft of the windshield. Openings are provided for a circuit breaker panel, an air outlet, an inspection panel for access to circuit breaker panel electrical connection points, map light, microphone, phone jacks, air temperature sensor vent (pilot side), and a control unit. The cockpit control unit provides selections for the desired compartment lighting.

Lower Sidewalls

Figure 1

The lower sidewalls contain open storage areas and provide outlets for crew mask oxygen.

Kick Panels

Figure 1

Kick panels are provided in the flight compartment, with an aft and forward kick panel on each side.

The aft kick panels reach from the forward right closet and forward left cabinet to the forward edge of the lower sidewall, and from the floorboards up to the lower sidewall panels.

The forward kick panels cover the areas forward of the lower sidewall panels and below the instrument panel to the forward pressure bulkhead. The forward kick panels contain variable-opening air outlets for the cockpit area.

Floor Covering

Figure 1

The cockpit floor covering provides a pleasing style and noise reduction for the lower area of the flight compartment.

Rudder Pedal Shroud

Figure 1

Pilots are protected from the mechanical workings of the rudder pedal quadrant by the rudder pedal shroud.

Glareshield

Figure 1

The glareshield is located above the instrument panel and provides shade to ease reading of flight instruments and CRTs. The glareshield has two aft glareshield extensions to provide additional shading during unusual circumstances.

Center Post Cover

Figure 1

The center post cover hides the windshield center support and the structures holding the compass and eye reference locator.

Eye Reference Locator

Figure 1

The eye reference locator indicates the optimum head position for crewmember viewing of the instrument panel and through the windshield. The seat should be adjusted so each crewmember sees two balls only (forward and their side) on a horizontal plane.

Cockpit Speakers

Figure 1

The two cockpit speakers are mounted directly above the crew seats.

Cockpit Curtain

Figure 2

The cockpit curtain, mounted on a track immediately behind the crew seats, may be slid in place to separate the cockpit and passenger cabin areas.

Control Wheel Cover Plate

Figure 1

The control wheel closeout is provided by a two-piece control wheel cover plate.

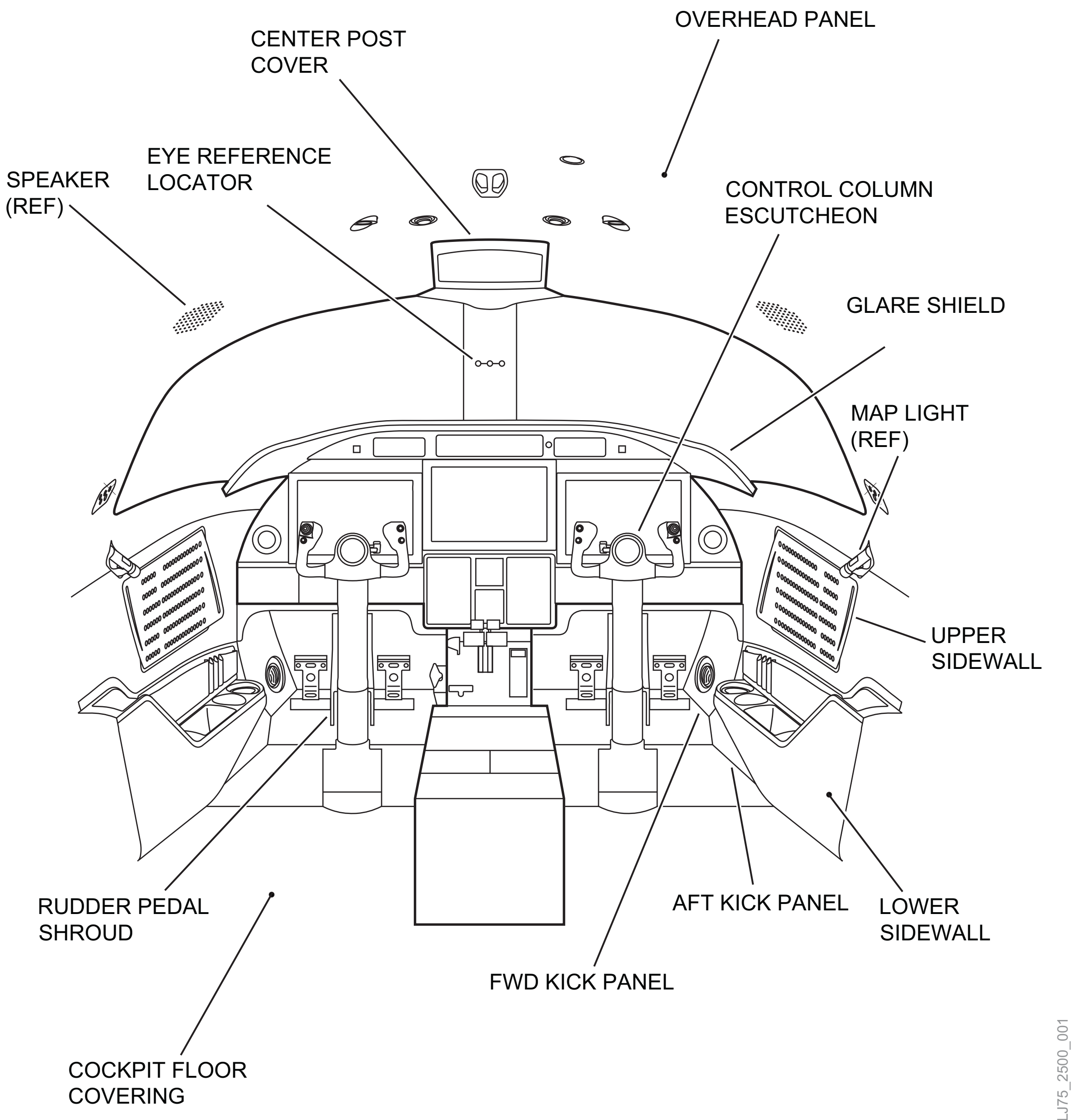


Fig. 1: Flight Compartment Equipment Locator

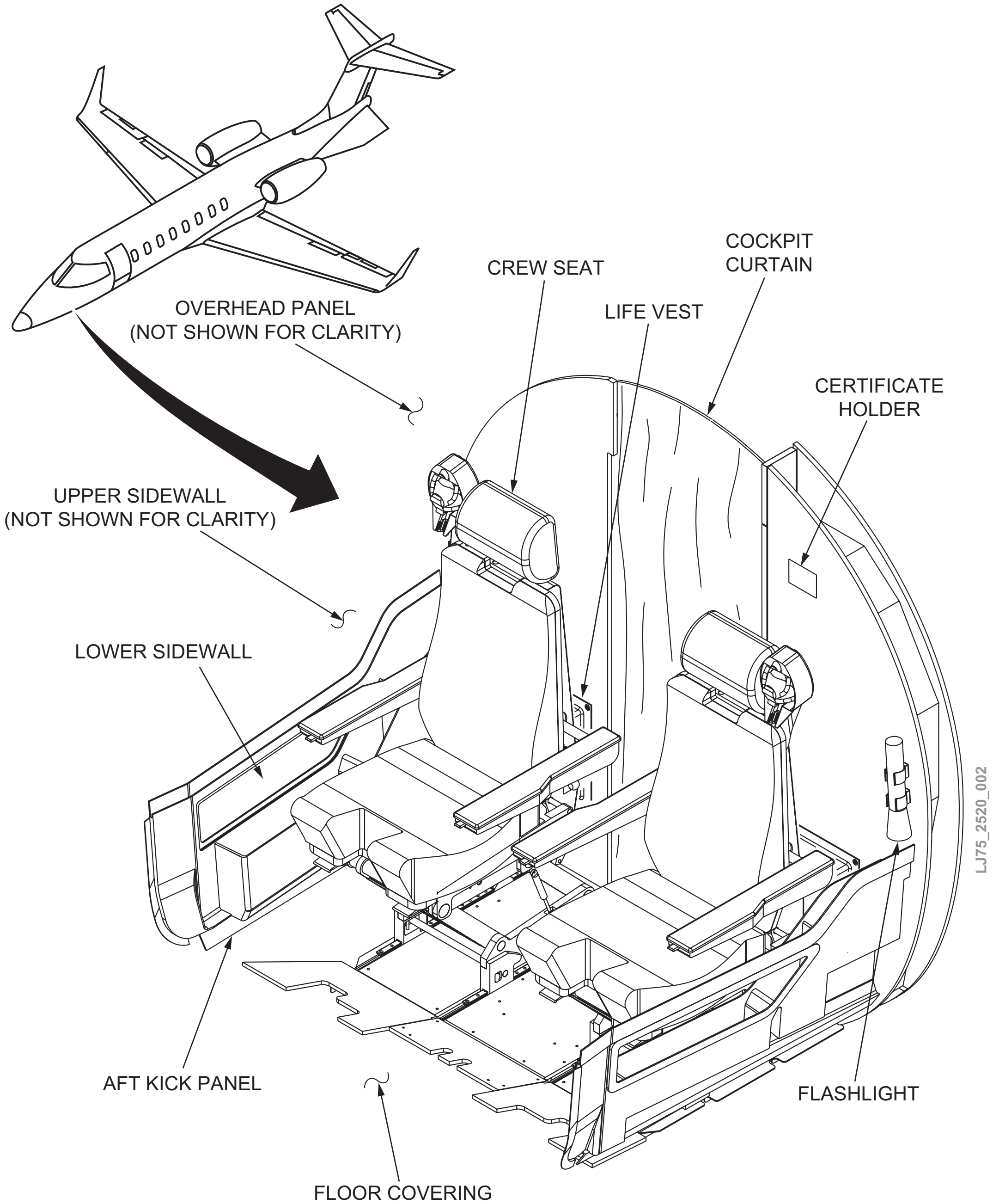


Fig. 2: Flight Compartment Equipment Locator

Certificate Holder

Figure 2

The certificate holder is bonded to the forward side of the left forward cabinet.

Drink Holders

A crew drink holder is attached on each upper sidewall panel forward of circuit breaker panel and provides a stowable beverage holder.

Crew Seats

Figure 3

Crew seats have built-in provisions for adjusting the headrest, seat back, lumbar support, seat bottom, armrest, and height. Adjustments may be made by the pilot or copilot while sitting in the seat. An oxygen mask, incorporating the oxygen flow indicator and microphone, is located on the upper outboard corner of the seat back. Each crew seat also incorporates a five-point restraint system consisting of two shoulder harnesses, two lap belts, and one crotch belt with a permanently attached rotary buckle. The lap belts and crotch belt are mounted to the seat base. An inertia reel lock, located on the lower inboard side of each seat back, maintains proper tension on both shoulder belts.

Crew Seat Operation

Figure 3

Horizontal Forward/Aft Adjustment

The control handle is located under the inboard front of the seat bottom. Press the control handle and at the same time, slide the seat forward or aft on the seat tracks. The seat locks in the selected position when the control handle is released.

Vertical Adjustment

Pressing the control handle on the outboard front of the seat bottom while under the occupant's weight causes the seat to move downward. When the seat is in the lower position and without applied weight, pressing the control handle causes the seat to raise by means of gas cylinders. The seat locks in the selected position when the control handle is released.

Recline Adjustment

The recline position of the seat back may be adjusted within a 5° to 25° range by pressing the handle located on the outboard seat side. The seat locks in the selected position when the control handle is released. Pressing the handle releases the locking mechanism.

Headrest

The headrest can be tilted forward to a 60° angle. A maximum vertical movement of 2.16 in. (55 mm) can be obtained by pressing or lifting the headrest.

Inertia Reel Lock Control

The shoulder harness inertia reel lock control is located on the inboard lower side of the seat back.

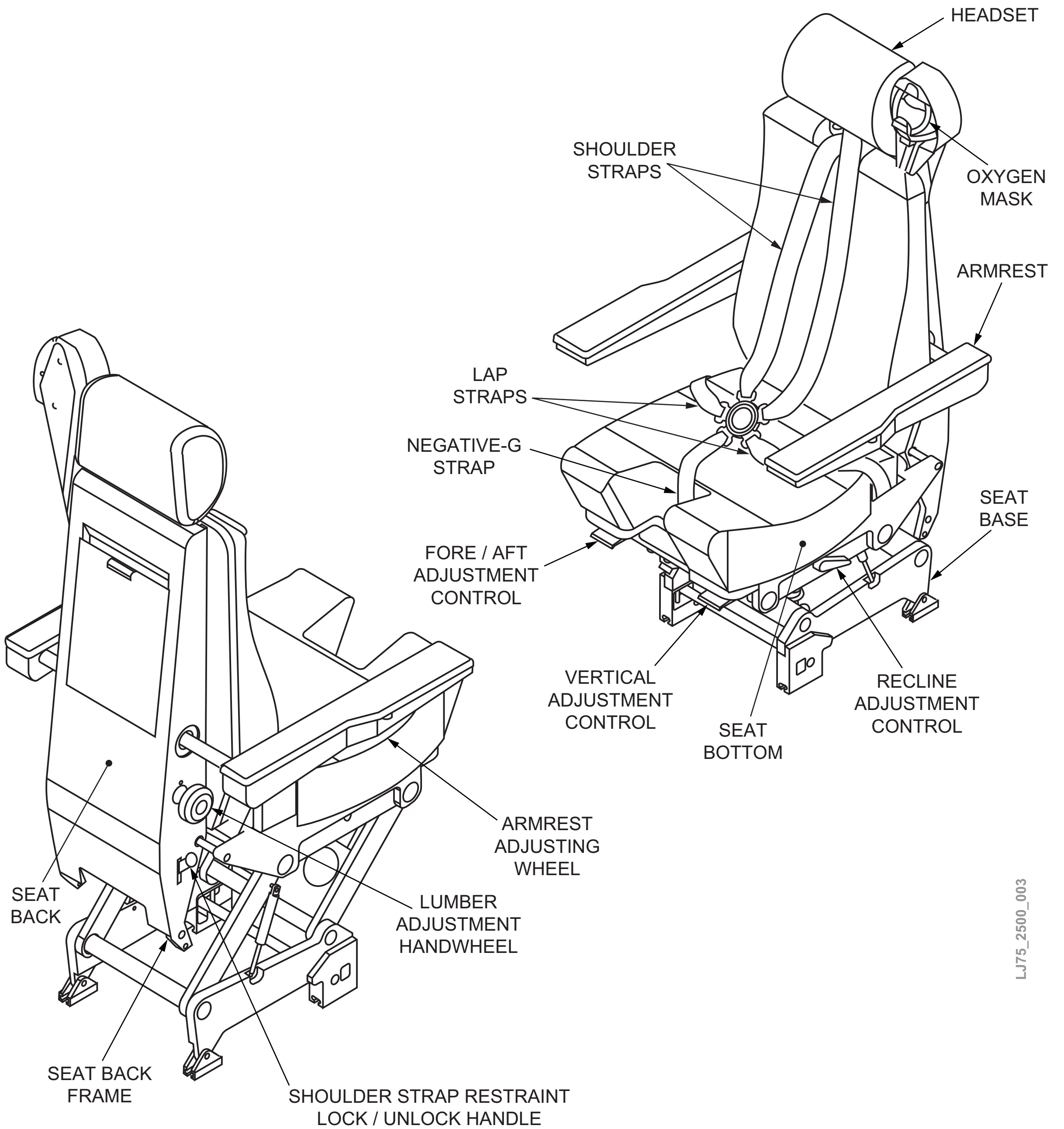


Fig. 3: Crew Seat

PASSENGER COMPARTMENT

(ATA 25-20-00)

OVERVIEW

The passenger compartment is the area where passengers are seated, aft of the flight compartment and forward of the lavatory. The passenger compartment configuration varies depending on the floorplan configuration.

COMPONENTS

The following components are installed in the passenger compartment (quantities vary due to interior completion options):

- Passenger cabin headliner
- Convenience panels
- Upper sidewall panels
- Window shade assemblies
- Emergency exit door closeout panel
- Executive table
- Armrest caps
- Lower sidewall panels
- Kick panels
- Floor covering
- Passenger/crew door closeout
- Passenger/crew door stairs covering
- Passenger seats

COMPONENT DESCRIPTION AND OPERATION

Passenger Cabin Headliner

Figure 4

The passenger cabin headliner is in conjunction with, but separate from, the entryway and the lavatory headliners. It begins at the entryway at fuselage station 256 and extends aft to the aft cabin partition at fuselage station 418. The cabin headliner is secured in place by retaining channels. Passenger oxygen masks are contained in stowage boxes located at the center of the headliner. Masks automatically deploy if the cabin pressure drops during flight.

Convenience Panels

Figure 4

Convenience panels, located above cabin seats, provide additional components for passenger comfort. Individual panels include spot and cabin lighting, air gaspers, and cabin speakers. Panels run the entire length of the passenger cabin and lavatory. Panels are secured individually, facilitating installation and removal of component assemblies.

Upper Sidewall Panels

Figure 5

The upper sidewall panels, and corresponding window shade assemblies, cover the upper

passenger cabin walls from the headliner to the armrest.

Window Shade Assemblies

Figure 5

Window shade assemblies correspond with cabin sidewalls to form the upper interior cabin walls.

Emergency Exit Door Closeout

Figure 5

The emergency exit door closeout panels are constructed to provide an armrest ledge and upper sidewall closeout. These exactly match the rest of the cabin interior, while providing easy removal and installation of the escape hatch.

Executive Table

Figure 5

The executive table is stowed within the armrest assembly. It easily deploys to provide additional work or entertainment space for passengers.

Armrest Caps

Figure 5

The six individual armrest assemblies form the lower internal passenger cabin wall. Armrest caps contain control switch panels, drink holders, storage boxes, and tables. The armrest configuration varies depending upon customer- selected cabin interiors.

Lower Sidewall Panels

Figure 5

The lower sidewall panels run below the armrest cap assemblies from fuselage station 256 aft to fuselage station 417.

Kick Panels

Figure 5

Kick panels finish the cabin sidewall closeout from below the lower armrest panels to the cabin air ducts running along both sides of the cabin floor. A total of six kick panels are installed the entire length of the passenger cabin.

Floor Covering

Figure 5

The aisle floor covering runs from the cockpit fuselage station 225 aft through the lavatory to fuselage station 443. Coverage extends outboard to surround the passenger seating and upward to meet the lower armrests.

Passenger/Crew Door Closeout

The door panel covers and protects the upper interior of the passenger/crew door. The door handle, door lock, and lock indicators are included in the panel.

Passenger/Crew Door Stairs Covering

The lower portion of the passenger/crew door contains the entry stairway. It is protected by a rubberized mat and contains the opening handle and access panels to inner door mechanisms.

Passenger Seats

Figure 5

The passenger seats are single-place, variable-position seats facing forward and aft with an adjustable headrest. Each seat is equipped with a three-point restraint system consisting of two lap belts and a shoulder belt. The shoulder belt is connected to an inertial reel for ease of movement during flight. Each seat in the passenger compartment is capable of moving inboard approximately 4.5 in. (11.4 cm) to accommodate a 180° swivel at the base, in addition to a fully reclining seat back. Life vest stowage is located in the seat pedestal, beneath each seat. The passenger compartment seating configuration varies, depending on the selected floorplan.

Passenger Restraint Belts

Figure 5

Lap and shoulder passenger restraint belts are provided at each seat for passenger safety. The shoulder belt includes an inertia reel for ease of movement.

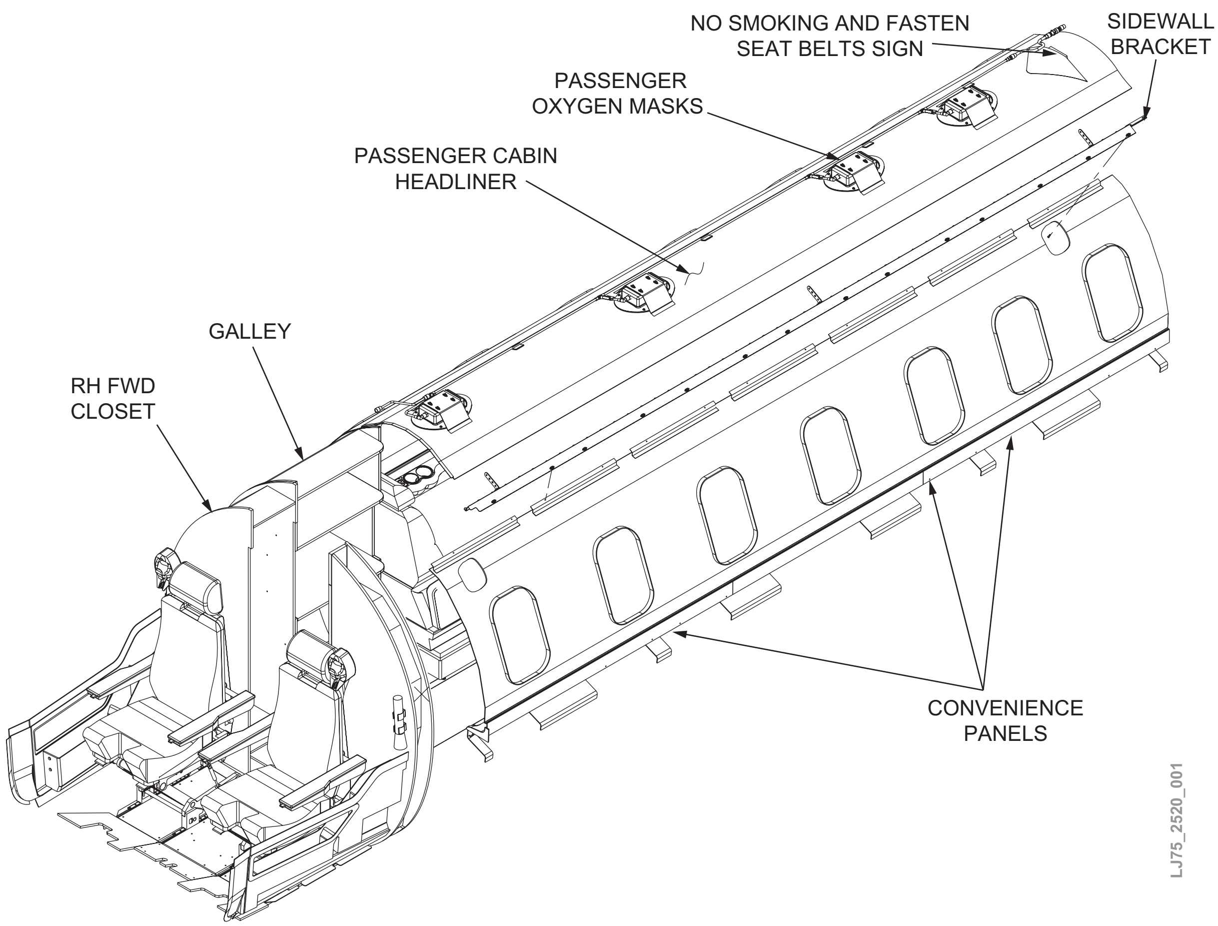


Fig. 4: Passenger Compartment Headliner Installation

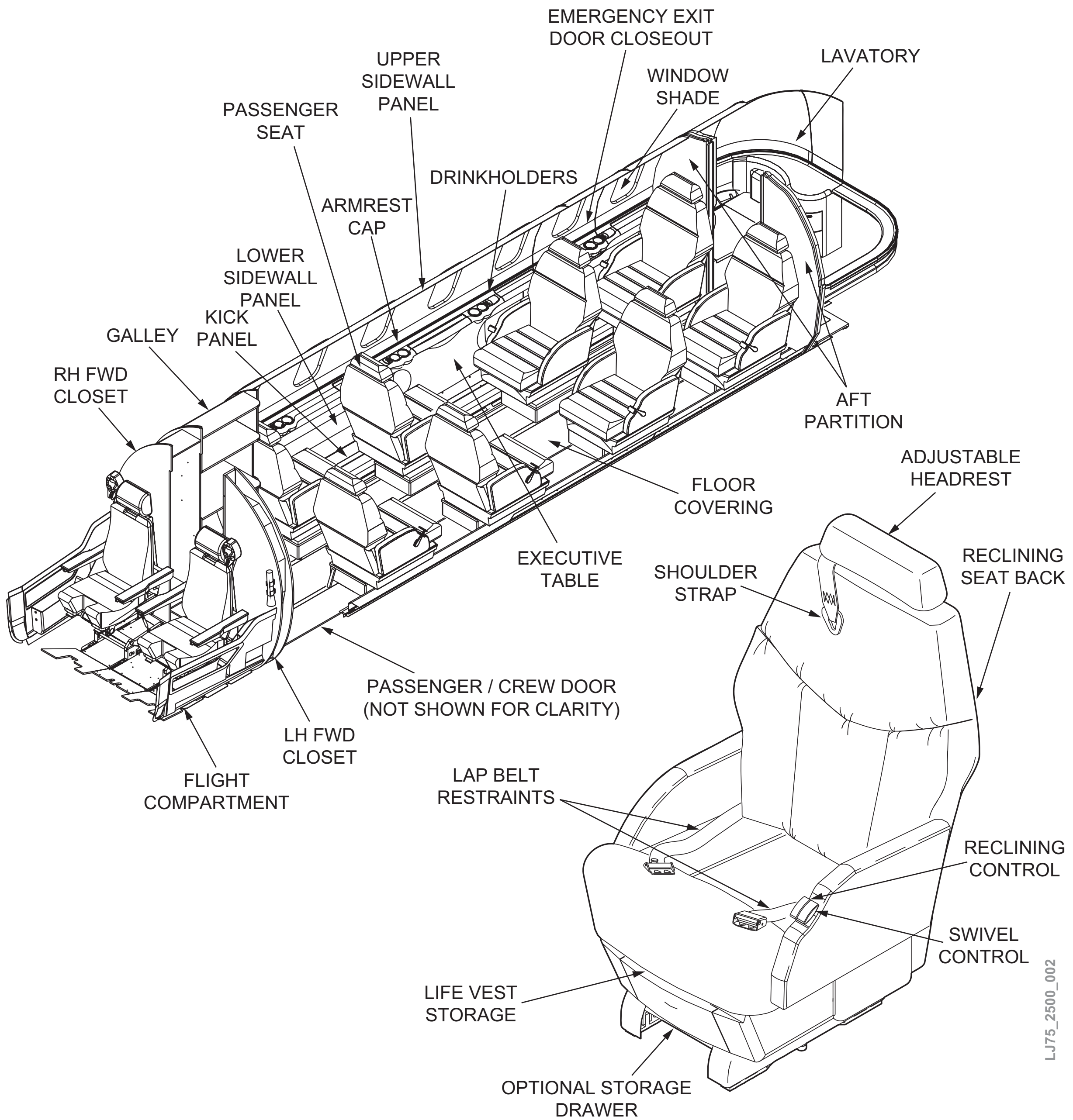


Fig. 5: Passenger Compartment Component Locator

GALLEY

(ATA 25-30-00)

OVERVIEW

The galley is a cabinet in the aircraft for refreshment storage and preparation. The galley is located in the right forward portion of the passenger compartment. Arrangement of the galley varies depending upon customer selection.

COMPONENTS

The galley consists of the following components:

- Galley
- Galley headliner

COMPONENT DESCRIPTION AND OPERATION

Galley

Figure 6

The galley cabinet provides illuminated storage compartments for food and other items. A trash container, heated water dispenser, bottled water, and ice storage containers are also included. Drainage for the galley is provided by a momentary switch which actuates a drain solenoid for opening and closing the drain line. A heated drain mast, for drip tray and ice drawers, completes the drain line outside the aircraft.

Galley Headliner

The galley headliner panel provides a finished ceiling in the galley area and entryway from approximately FS 260 forward to the cockpit curtain track. It is secured in place by retaining channels, a cockpit curtain track, and passenger/crew door trim panel.

SYSTEM OPERATION

Depressing the HOT LIQUIDS circuit breaker, located on the copilot circuit breaker panel, provides electrical power through the latching LIQUID WARM switch to the locking relay. The relay is activated and electrically locked closed. Electrical power is provided back to the second half of latching LIQUID WARM switch. Depressing the latching LIQUID WARM switch provides electrical power to the liquid warmer and annunciators within the latching LIQUID WARM switch, while disengaging the other latching LIQUID WARM switch half that provides electrical power to the locking relay. If electrical power is removed and reapplied to the aircraft while the liquid warmer is activated, the locking relay drops out and the warmer does not reactivate until the latching LIQUID WARM switch is cycled.

Power is supplied to the momentary DRAIN switch through the HOT LIQUIDS circuit breaker located on the copilot circuit breaker panel. While the DRAIN switch is depressed, the switch annunciator illuminates and the drain solenoid opens.

The galley fluorescent lights and annunciator illuminate when the latching galley LIGHT

switch and the GALLEY LTS circuit breaker, located on the copilot circuit breaker panel, are depressed.

Power is delivered from the latching galley LIGHT switch to the fluorescent light inverter and out to the fluorescent lamps.

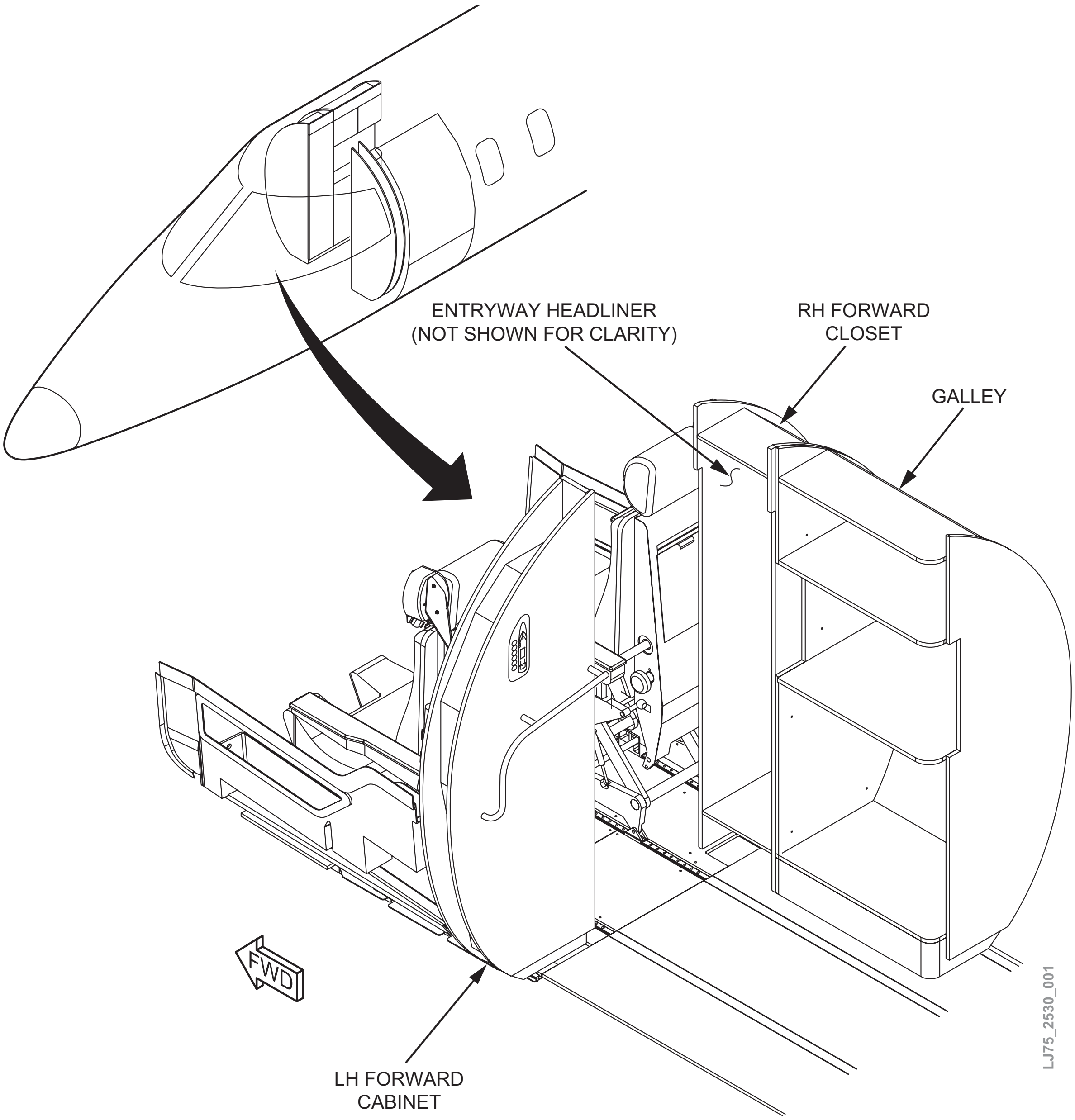


Fig. 6: Galley Location

LAVATORY

(ATA 25-40-00)

OVERVIEW

Figure 7

The lavatory is located from FS 419 to FS 457. The passenger and lavatory compartments are separated by a partition and sliding doors. The lavatory interior includes a vanity with storage area and trash container.

An externally serviceable toilet is surrounded by upholstered shrouds. A contact pad is installed on the aft side of the right partition. A stowage area is provided with restraining net and coat rod.

COMPONENTS

The lavatory consists of the following components:

- Aft cabin partition
- Contact pad
- Lavatory headliner
- Convenience panels
- Lavatory upper sidewalls
- Lavatory lower sidewalls
- Lavatory floor covering
- Lavatory toilet shroud
- Lavatory vanity

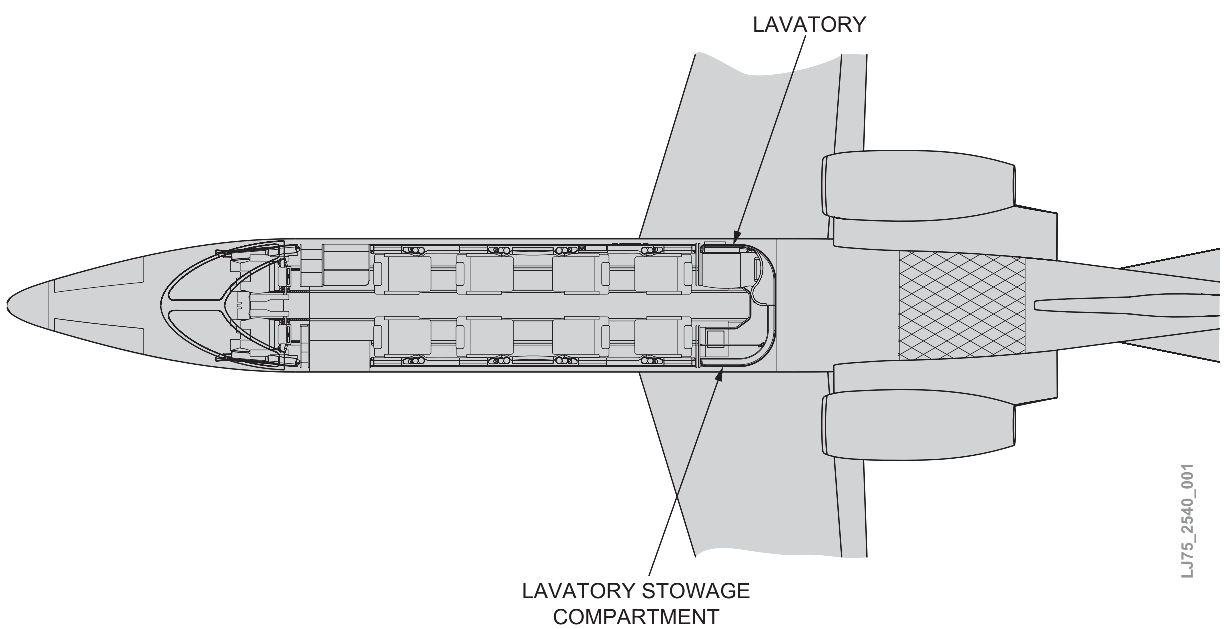


Fig. 7: Lavatory Location

COMPONENT DESCRIPTION AND OPERATION

Aft Cabin Partition

Figure 8

The aft cabin partition, located at FS 418, contains a solid sliding door which separates the passenger cabin from the lavatory compartment.

Contact Pad

Figure 8

A contact pad is installed in the lavatory on the aft side of the right partition.

Lavatory Headliner

The lavatory headliner is separate from the passenger compartment headliner. An oxygen mask drop-down box is centrally installed. There are no electrical connections installed in the lavatory headliner.

Convenience Panels

Convenience panels, located in conjunction with the lavatory headliner, provide overhead lavatory lighting and air, spotlights, and air gaspers.

Lavatory Upper Sidewalls

Lavatory upper sidewall panels cover the upper compartment walls from convenience panels to the armrest cap.

Lavatory Lower Sidewalls

Lavatory lower sidewall panels begin below the armrest cap and extend to the cabin kick panels and floor covering in the lavatory stowage compartment. Lower sidewall panels cover from the lavatory vanity to the left aft cabin partition. There is a cabin air outlet in the left lower sidewall.

Lavatory Floor Covering

The lavatory floor covering provides complete coverage and trim for the raised floor, from the center aisle upward to the sidewall. The center aisle floor covering is a continuation of the passenger compartment floor covering installation.

Lavatory Toilet Shroud

Figure 8

The lavatory toilet shroud is the upholstered cabinet that surrounds and protects the toilet assembly and attaching parts. Cushion assemblies pad the shroud lid, back, and aft side.

Lavatory Vanity

Figure 8

The lavatory vanity is a modular upholstered cabinet which contains a storage area and waste container.

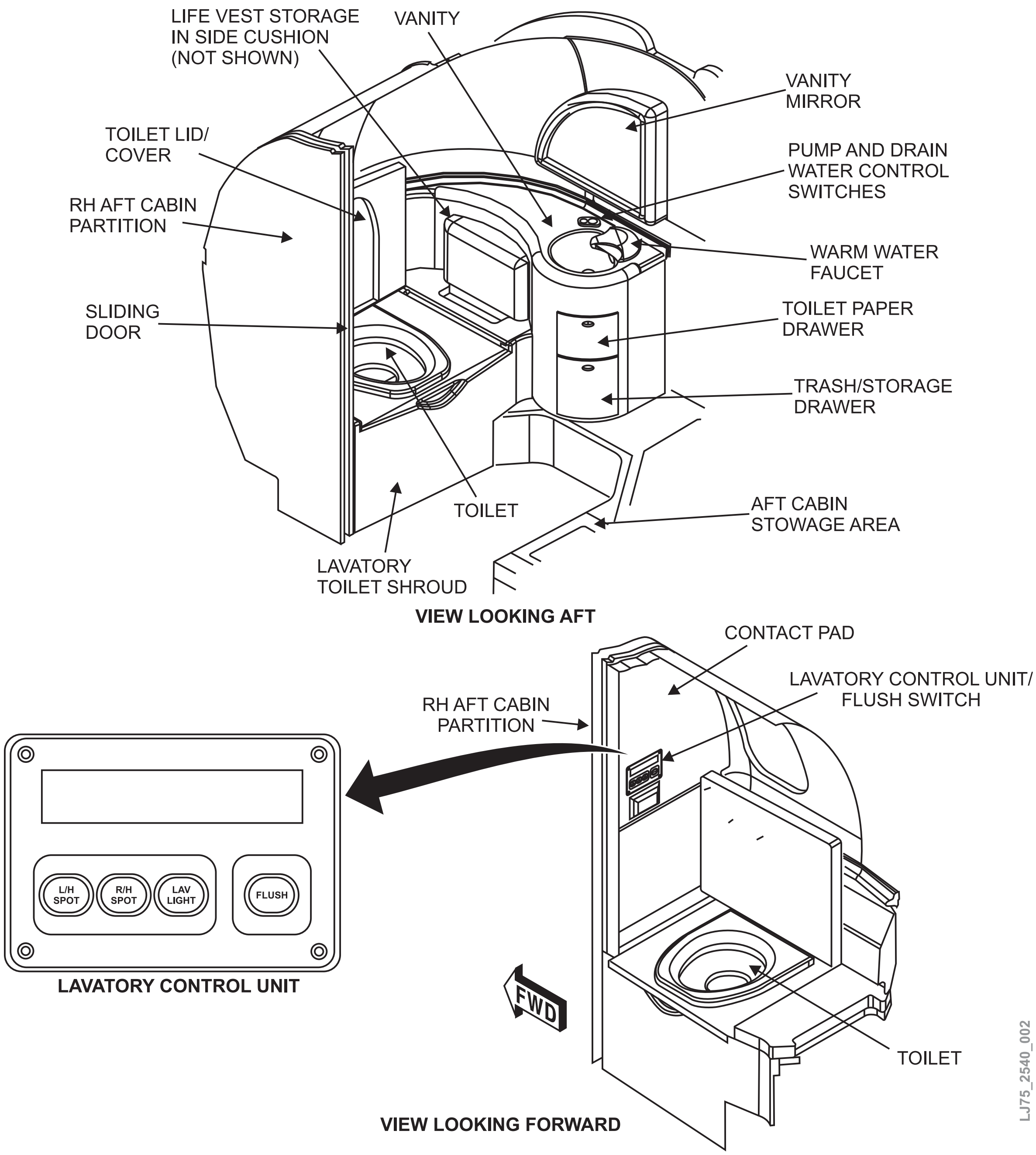


Fig. 8: Lavatory Component Locator

This page intentionally left blank

CARGO COMPARTMENT

(ATA 25-50-00)

OVERVIEW

There are three areas provided for the carrying of cargo and baggage.

The right forward closet, positioned between the cockpit and galley, provides an area for hanging and general storage. The lavatory stowage compartment offers a much larger space for hanging items and baggage.

The lavatory stowage area incorporates a coat rod for hanging items and a retention net to prevent baggage from shifting during flight.

The main baggage compartment is located in the tailcone. The main baggage compartment has a cargo restraining net located about midway between the forward and aft panels. There is also an additional volume box at the forward end of the main baggage compartment to accommodate most ski paraphernalia being carried in the baggage compartment.

COMPONENTS

The cargo compartments consist of the following components:

- Left forward cabinet
- Right forward closet
- Lavatory stowage retention net
- Lavatory stowage coat rod
- Baggage compartment
- Baggage component vent valves
- Baggage compartment cargo restraining net

COMPONENT DESCRIPTION AND OPERATION

Left Forward Cabinet

Figure 9

The left forward cabinet is a fixed cabinet which provides storage for up to six Jeppeson manuals. In addition, the cabinet contains the entry light switch panel and assist handle for crew and passenger boarding.

Right Forward Closet

Figure 9

The right forward closet, located forward of the galley, is a fixed cabinet that provides illuminated storage. A coat rod, adjustable shelves, and storage drawer are provided.

Lavatory Stowage Retention Net

Figure 9

The lavatory stowage retention net provides a removable closeout to the lavatory stowage compartment and prevents contents from shifting into the lavatory during flight.

Lavatory Stowage Coat Rod

Figure 9

The left side of the lavatory compartment provides an open stowage compartment and coat rod. The area is secured by the restraining net.

Baggage Compartment

Figures 9 and 11

The baggage compartment is located between FS 512 and FS 580. An additional volume box extends forward of FS 512. The compartment is illuminated by two interior and exterior lights and by an optional light on the underside of the pylon. The baggage compartment has thermostatically controlled heaters to prevent contents from freezing during flight.

Access to the compartment is gained through an external door on the left side of the tailcone.

Baggage Compartment Vent Valves

Figure 10

The baggage compartment vent valves are in the upper right corner of the aft bulkhead at FS 580. The vent valves allow external pressure and internal baggage compartment pressure to equalize during flight.

Baggage Compartment Cargo Restraining Net

Figure 11

The baggage compartment cargo restraining net is located about midway between FS 512 and FS 580. The baggage compartment cargo restraining net helps control cargo in the baggage compartment.

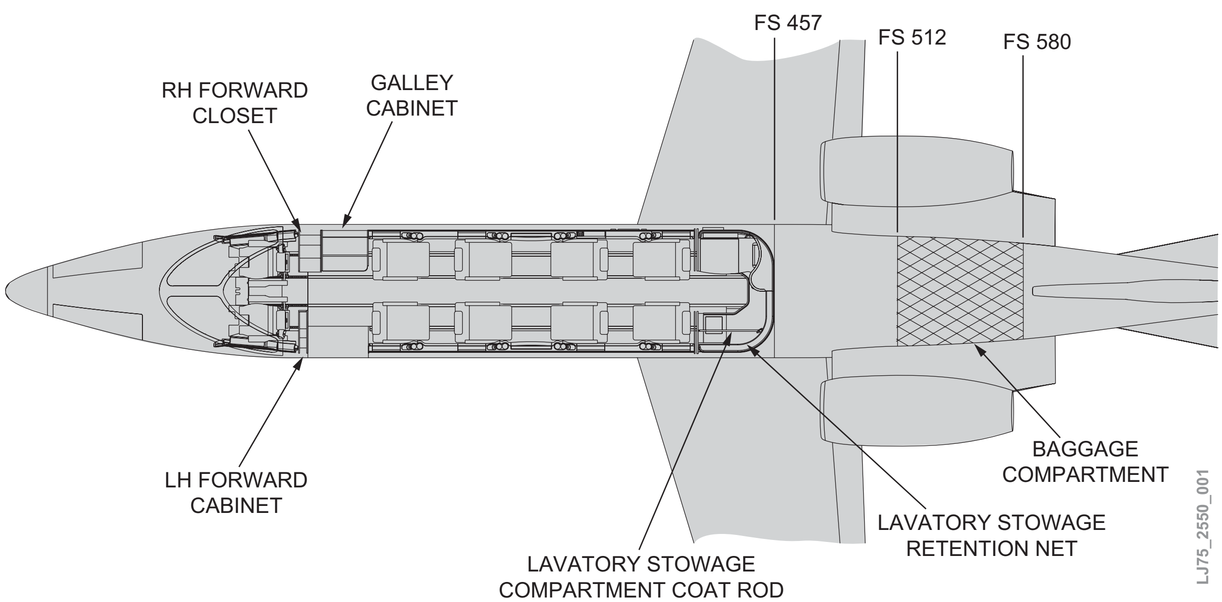


Fig. 9: Cargo Compartment Locations

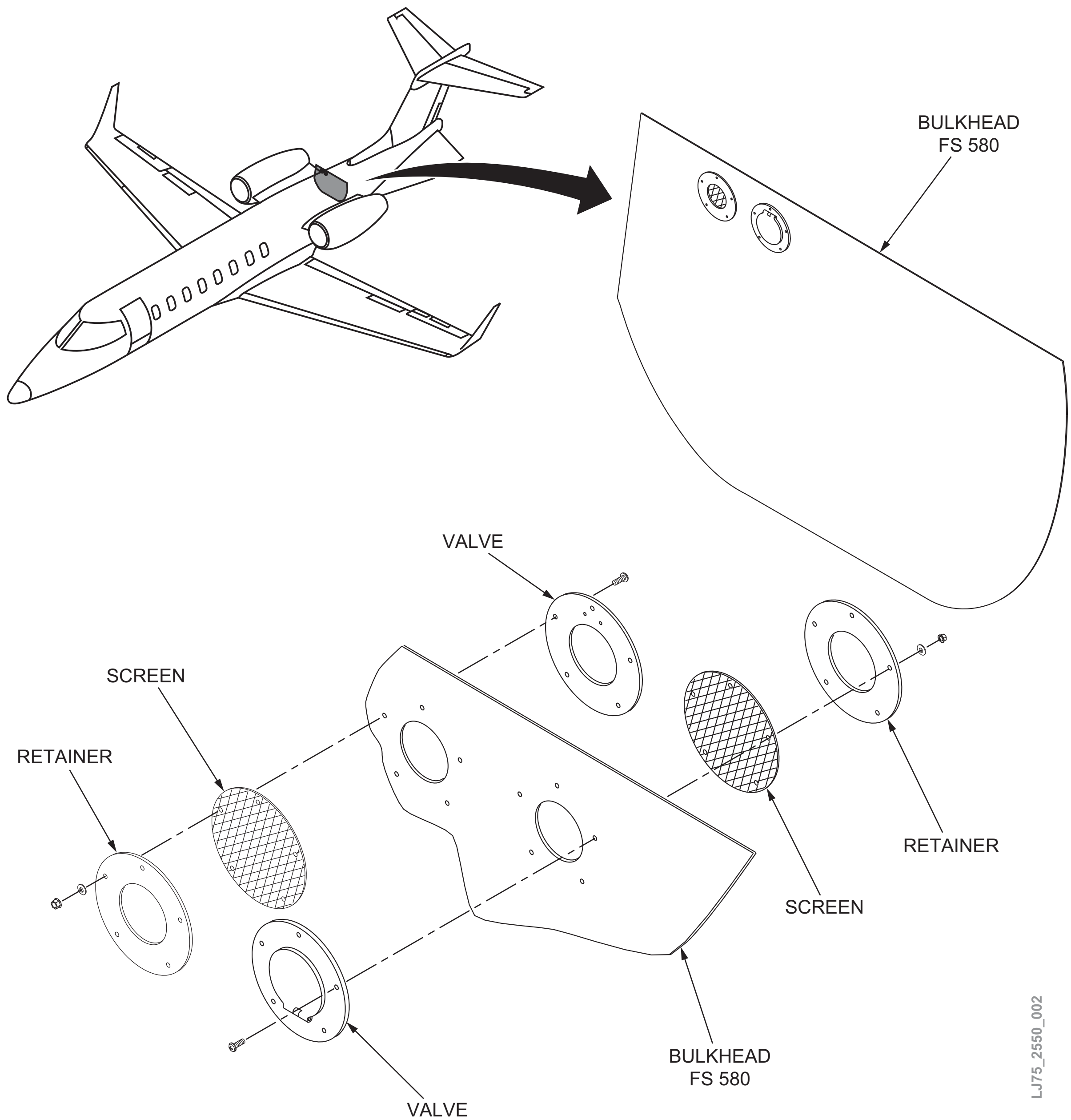


Fig. 10: Baggage Compartment Vent Valves

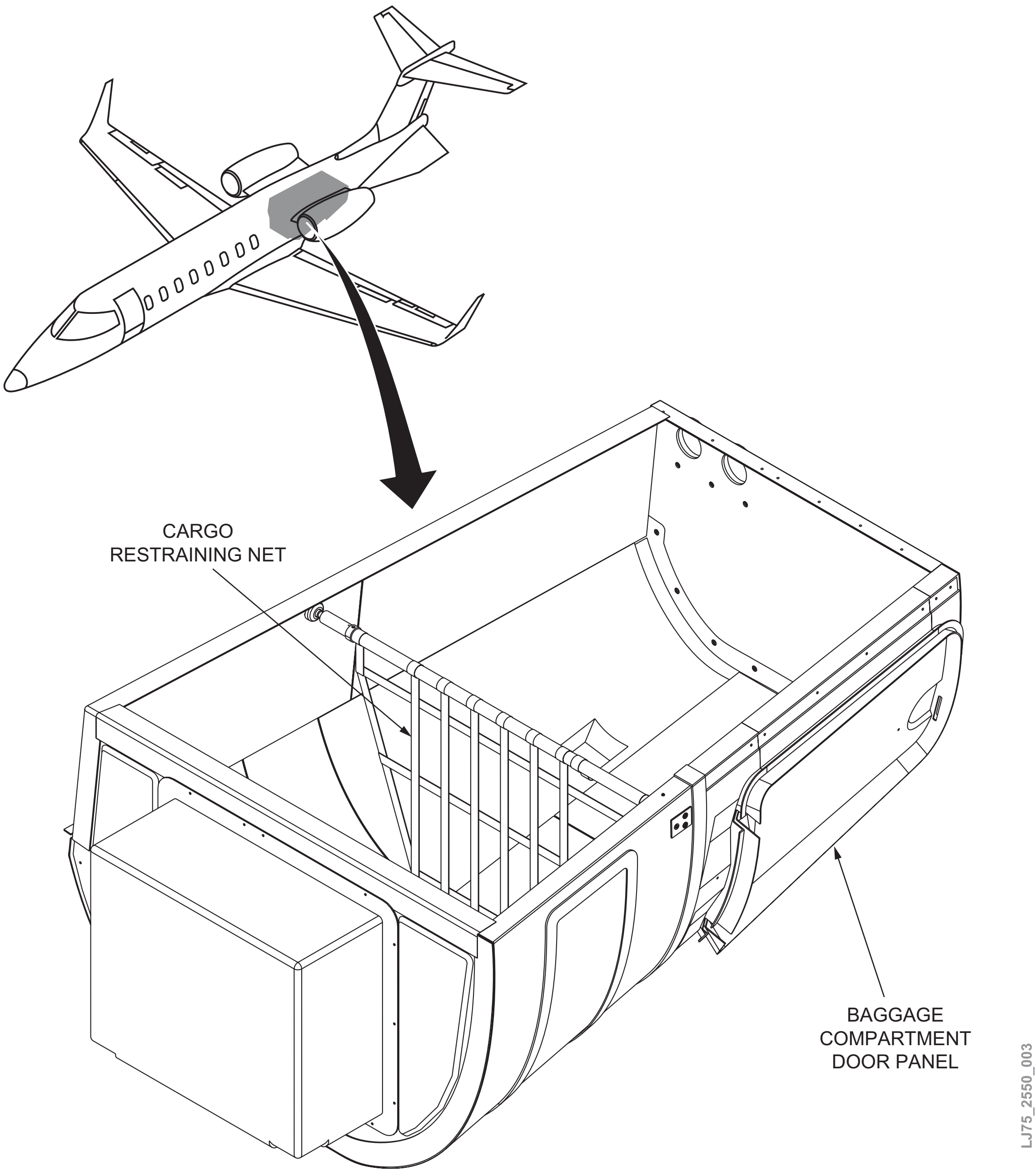


Fig. 11: Baggage Compartment Cargo Restraining Net

EMERGENCY EQUIPMENT

(ATA 25-60-00)

OVERVIEW

Emergency equipment is located in the flight and passenger compartments.

COMPONENTS

The following emergency equipment components are provided (quantities vary due to interior completion options):

- Life vests
- Flashlight
- Smoke goggles
- Information cards

COMPONENT DESCRIPTION AND OPERATION

Life Vests

Figures 12, 13, and 14

Life vests stowed in each passenger seat base are intended for emergency flotation during aircraft evacuation in water. Pilot and copilot life vests are stowed on the forward sides of the left cabinet and the right forward closet directly behind each crew seat.

Smoke Goggles

Figure 12

Smoke goggles are available for pilot and copilot use. The goggles are stowed in the lower cockpit sidewalls.

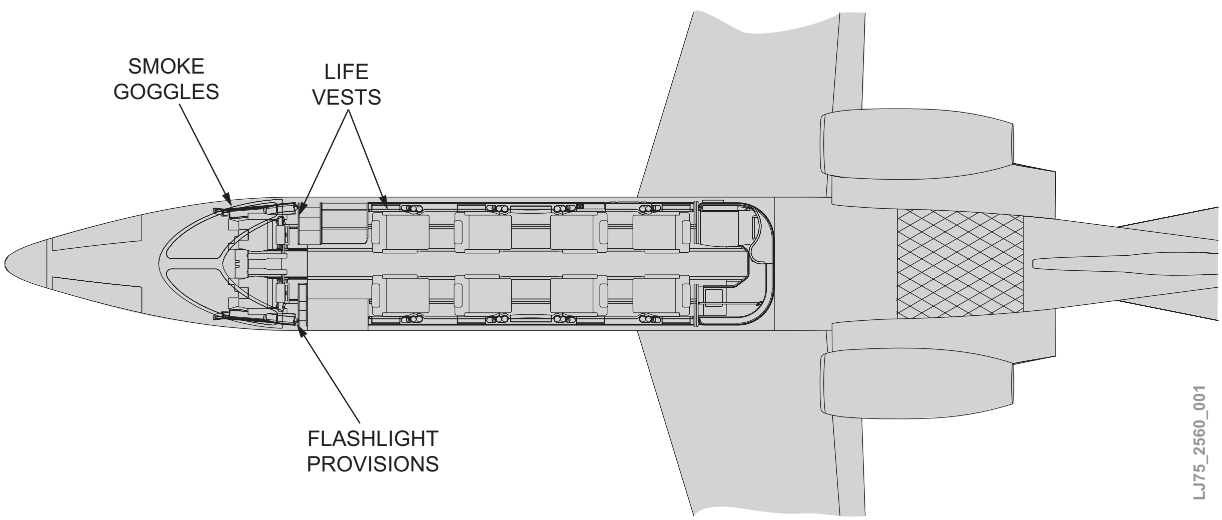


Fig. 12: Emergency Equipment Locations

Flashlight

Figure 14

Flashlight provisions are also located on the forward side of the left cabinet and right forward closet, directly behind and outboard of the crew seats.

Information Cards

The important information cards are placed at various locations throughout the aircraft, depending upon aircraft floorplan configuration. The cards contain information for passengers pertaining to emergency procedures (e.g., emergency exit, use of the emergency oxygen system, life vests, etc.).

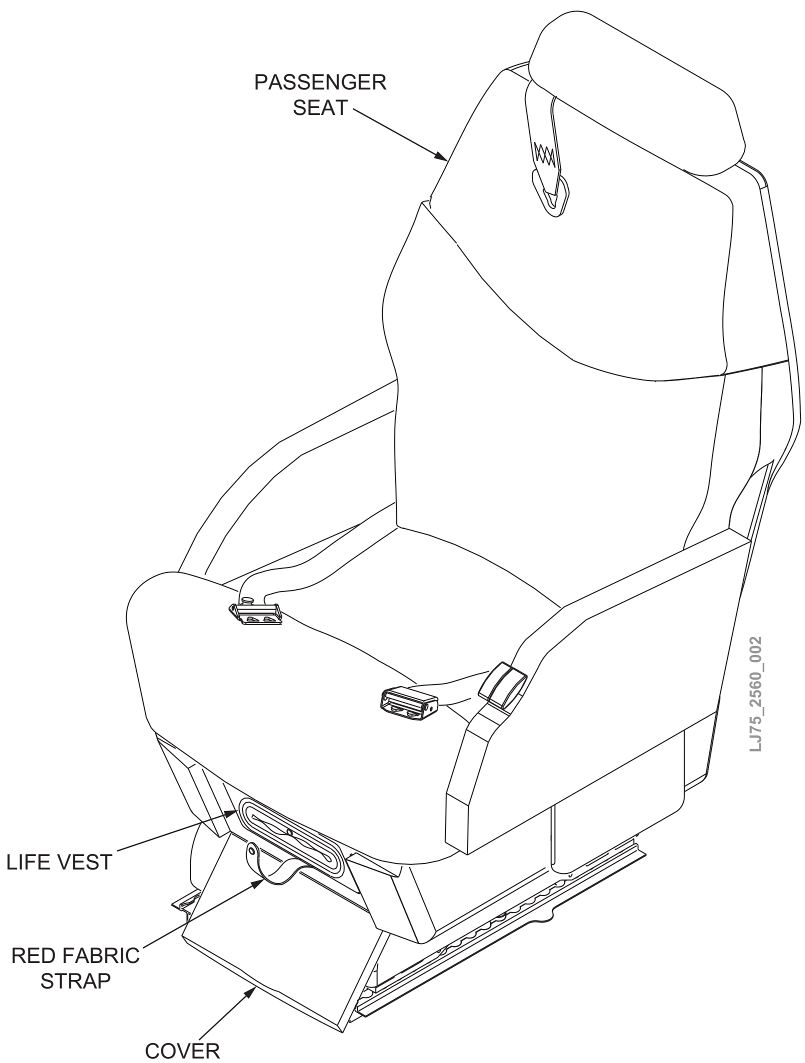


Fig. 13: Passenger Life Vest Installation

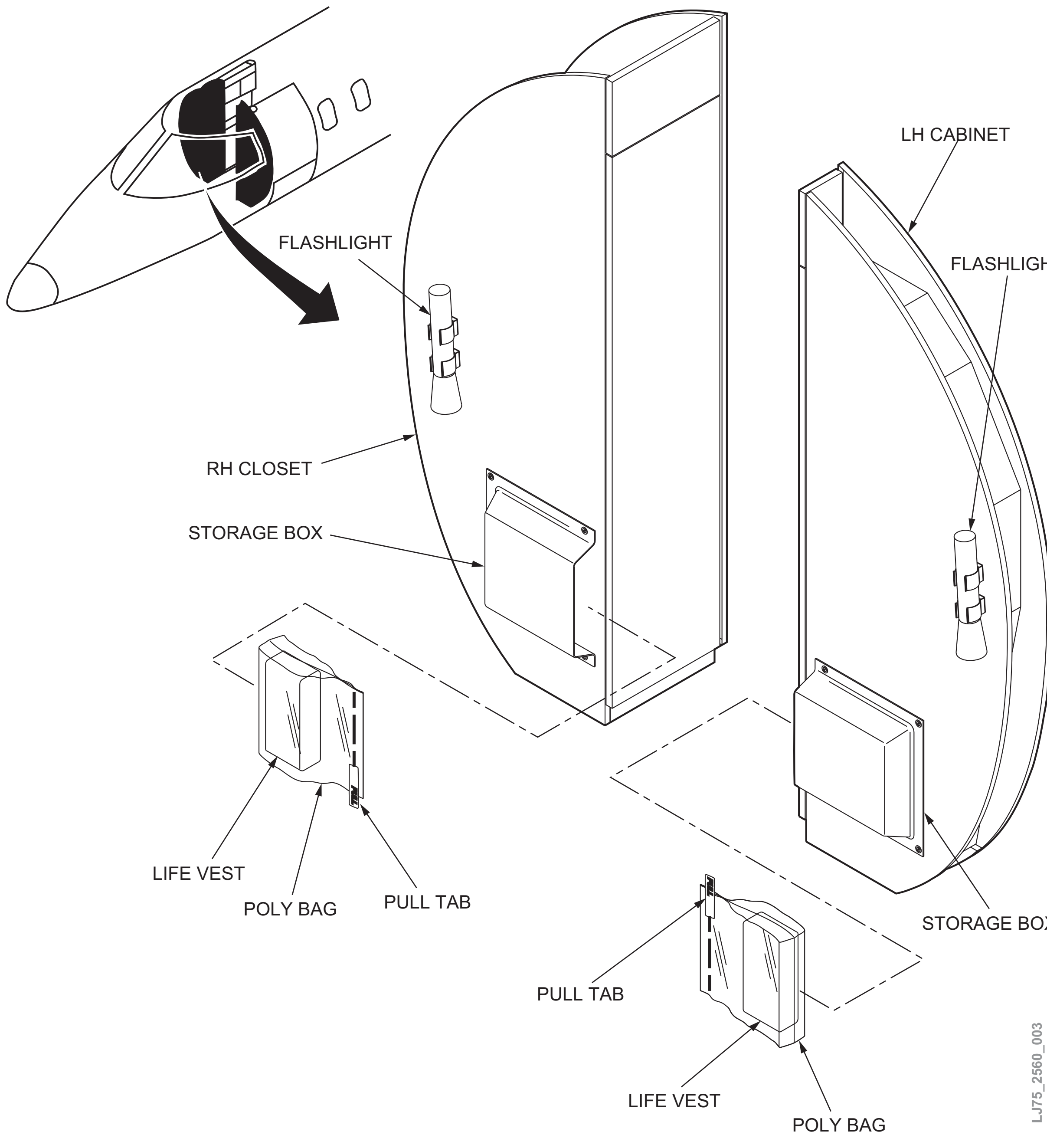


Fig. 14: Emergency Equipment Installation

This page intentionally left blank

UNDERWATER LOCATOR BEACON

(ATA 25-61-00)

OVERVIEW

The underwater locator beacon is an underwater locating device which, when activated, transmits a 10-millisecond acoustic pulse at 37.5 kHz once every second, and operates for up to 90 days after activation. The unit contains a switch, activated by either fresh or salt water, located at one end cap, a 7.9-volt lithium battery pack, a printed circuit board, a urethane-encapsulated transducer assembly, and shock cushions. The beacon operates at depths to 20,000 ft (6096 meters).

SYSTEM OPERATION

Figure 15

When submerged, the underwater locator beacon water-activated switch closes to allow a voltage potential into the printed circuit board. The circuit board generates all the necessary logic functions to produce a pulse with desired characteristics. The pulse is then transformed from a complementary metal oxide semiconductor (CMOS) level square wave, to a larger 37.5-kHz sinusoidal pulse by the transformer assembly. The output of the transformer drives the urethane-encapsulated transducer. The pulse then propagates through the housing and is transmitted in the form of a tuned 37.5-kHz acoustic signal.

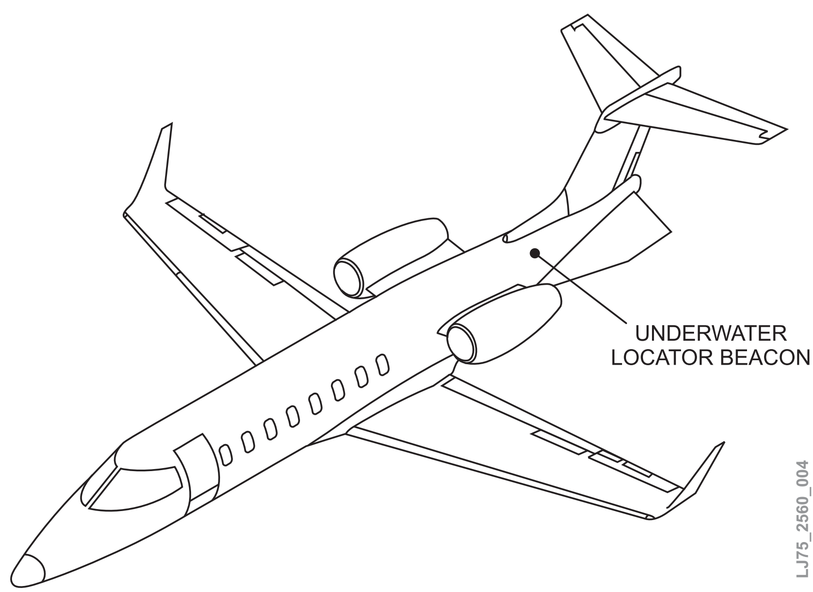


Fig. 15: Underwater Locator Beacon

This page intentionally left blank

EMERGENCY LOCATOR

(ATA 25-62-00)

OVERVIEW

Figure 16

The emergency locator (ELT) system provides a modulated emergency radio beacon to aid in locating a distressed aircraft. It also transmits a data burst every 50 seconds when active, communicating with COSPAS/SARSAT satellites. A built-in inertia switch automatically activates the transmitter after the unit is subjected to an impact such as would be experienced during a crash. It can also be manually activated via a remote control switch in the cockpit or by a switch located on the front panel of the ELT unit.

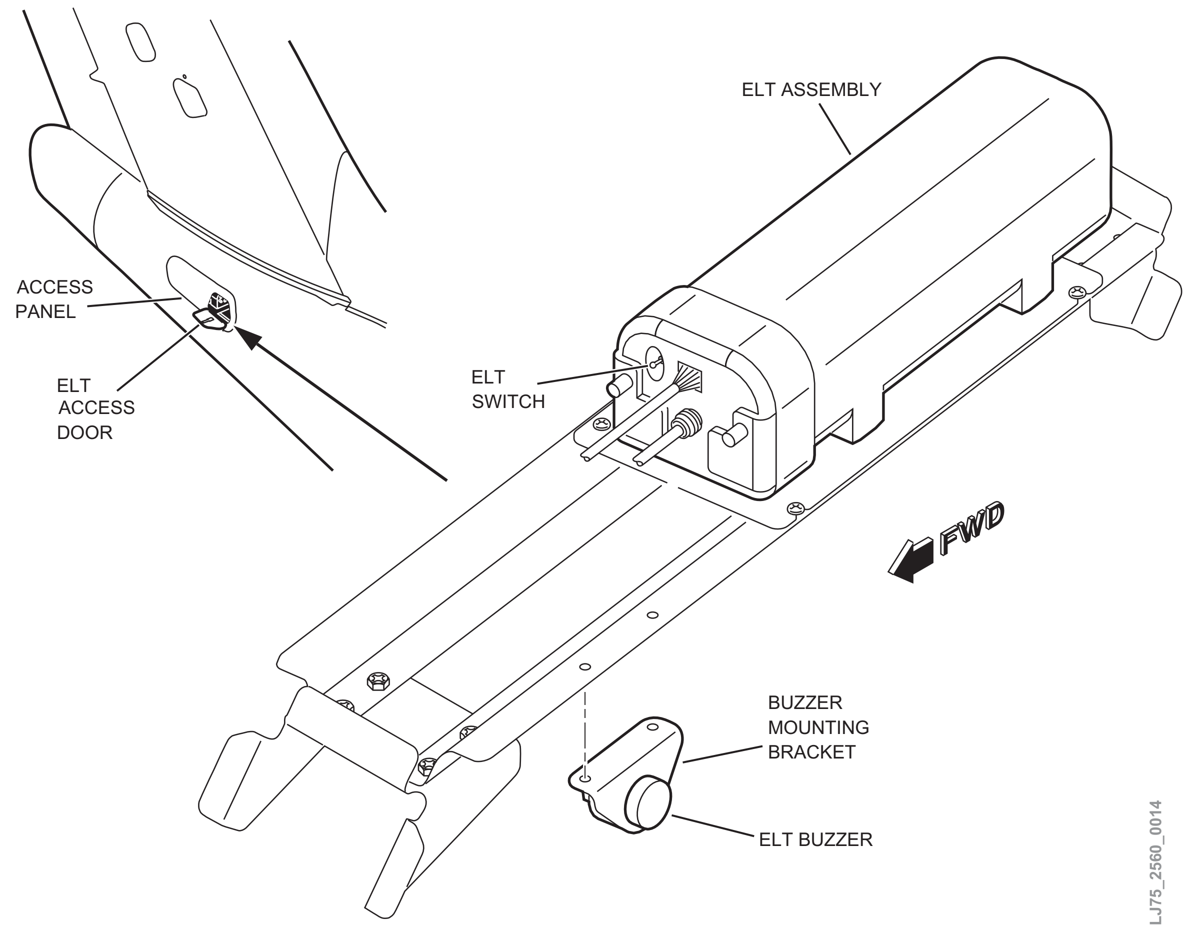


Fig. 16: Emergency Locator Transmitter

COMPONENTS

The emergency locator system consists of the following components:

- Emergency locator transmitter (ELT)
- ELT antenna

Associated Components

- ELT switch
- ELT buzzer

COMPONENTS DESCRIPTION

Emergency Locator Transmitter (ELT)

Figure 17

The main assembly is housed in a high-impact, fire resistant, polycarbonate plastic case, which is enclosed in a protective mounting frame assembly made of similar material.

The ELT main assembly and its mounting frame assembly are capable of withstanding extremely harsh environments and have been subjected to the rigorous environmental testing required by COSPAS-SARSAT for certification.

The ELT is a radio that transmits a signal to help search and rescue operations. The ELT transmits on a frequency of 121.5 MHz (VHF) and 243.0 MHz (UHF) and will continue to operate until the batteries are exhausted, which is typically at least 50 hr. It also transmits a digital code on 406 MHz for aircraft identification to satellite for 24 hr, and then shuts down automatically. The ELT is mounted in the right side of the tailcone.

When the ELT is activated, the signals are transmitted until the battery pack loses power (approximately 50 hr) or the system is reset. The battery pack is internal to the ELT, and it supplies electrical power to the buzzer and remote control.

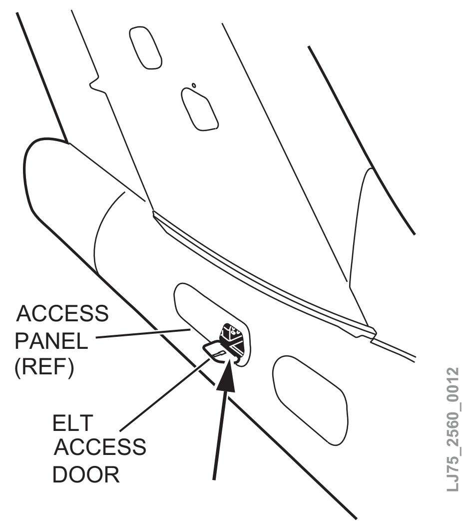


Fig. 17: Emergency Locator Transmitter

Emergency Locator Antenna

Figure 18

The emergency locator antenna sends the emergency signal when the system is activated. It is a blade-type antenna connected directly to the ELT via a single coaxial cable assembly. The antenna is installed on top of the aircraft, left of aircraft centerline at approximately FS585. The operating frequencies are 121.5, 243.0, and 406.025 MHz.

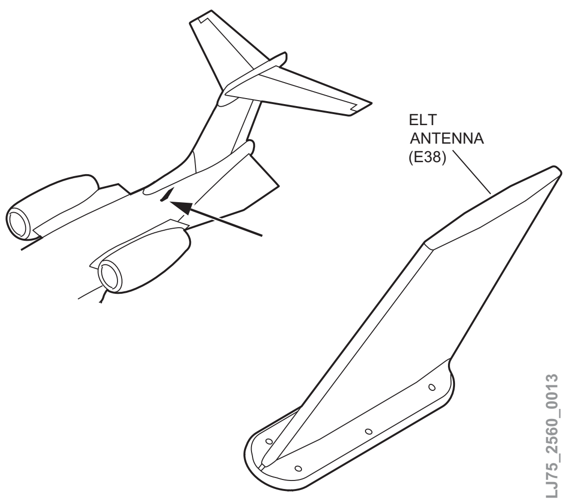


Fig. 18: Emergency Locator Antenna

ELT Switch

Figure 19

The ELT switch is a two-position switch: ON and ARM. The ON position sends an emergency signal from the ELT. The ARM position is the normal in-flight position.

The ELT switch is located on the forward quadrant switch panel (P6) of the forward pedestal. This is a remote-control switch for the ELT system.

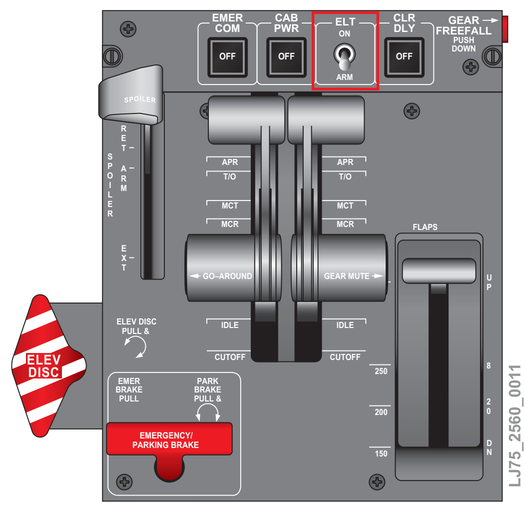


Fig. 19: ELT Switch

Emergency Locator Buzzer

Figure 16

The buzzer is in the aft equipment compartment. It is installed on a bracket attached to the bottom of the ELT rack. The buzzer operates when the ELT transmits.

SYSTEM OPERATION

The ELT mode of operation is selectable via the cockpit-mounted remote switch, or by the master switch located on the face of the ELT unit.

During normal operation, the Cockpit Remote switch is in the “ARM” position. The Local switch on the ELT is in the “OFF” position. The Aircraft Navigation System is active.

ELT Operating Modes

Remote ARM Mode—When the ELT unit master switch and the remote switch are in the ARM position, the ELT operates in the normal armed or automatic manner. Under this condition, the ELT transmits if the inertia switch located in the ELT is activated. The inertia switch typically requires a force of approximately 2G to activate.

Remote ON Mode—Selecting the remote switch to the ON position turns the ELT transmitter on. This action also posts an ELT ON status CAS message on the EICAS display and activates the ELT buzzer. Selecting the remote switch back to the ARM position terminates the ELT transmissions. This procedure also extinguishes the ELT ON CAS message and turns off the ELT buzzer.

Manual ON Mode—Manual ON mode is selected by switching the master switch on the face of the ELT unit to the ON position. The ELT transmitter transmits, the ELT ON status CAS message posts on EICAS, and the ELT buzzer activates.

ELT Reset—If the ELT is activated accidentally, it will need to be reset. Reset the ELT from the cockpit by moving the remote switch to the ON position, waiting approximately 1 second, and then moving it back to the ARM position. If the switch is already in the ON position, move it to the ARM position.

Programming

The ELT requires programming to input the data to be transmitted to the COSPAS SARSAT satellite system.

The ELT programming enables search and rescue personnel to determine the following:

- Serial identification number
- Aircraft 24-bit address (ICAO international serial number, same as Mode S address)
- Aircraft operator designator (including telephone contact numbers)
- Aircraft nationality and registration

The C406-N ELT can only be programmed by the vendor or a vendor-authorized facility.

Registration

Responsibility

It is the responsibility of the aircraft owner to register the ELT.

- If an ELT is moved to a different aircraft (i.e., an aircraft other than the one it was originally installed on), and/or the aircraft is registered in a new country, the ELT must be registered again
- If the aircraft is registered in a new country, the ELT must be registered again
- The product label must be marked with the new HEX ID code to indicate new programming, if applicable

Required Information

The following information is required when registering an ELT:

- Unique Hex ID code printed on the ELT product label
- Information in Subtask 25-62-13-990-002, on page 83 of the Cobham Avionics Wulfsberg Electronics Abbreviated Component Maintenance Manual C406-N (453-5060), C406-N HM (453-5061)

Information (i.e., address, telephone number, etc.), filed as part of the registration process, should be kept up to date.

Where to Register

- In the United States, the National Oceanic and Atmospheric Administration (NOAA) is the registration agency
- Specific registration web sites and information may be found at:
  - Artex web site at www.artex.net, which has links to online registration sites and also a link to registration forms and instructions for a number of countries
  - ELT may also be registered in the United States by going directly to the NOAA ELT registration web site at www.beaconregistration.noaa.gov

NOTE

NOAA may also be contacted by mail at:
SARSAT Beacon Registration
NSOF, E/SP3
4231 Suitland Road
Suitland, MD 20746-4304

or by phone at 1-888-212-7283 or 301-817-4565.

- In other countries, the national civil aviation authority in the applicable country should be contacted to obtain registration information

Battery Replacement

The battery pack must be replaced under any of the following conditions:

- After use in an emergency
- After inadvertent activation of an unknown duration
- When the total of all known transmissions exceeds 1 hr
- On or before the expiration date stamped on the ELT battery label and battery pack
- After 6yr of shelf or service life

System Interface

The ELT is connected to the remote switch, ELT antenna, no. 1 data concentrator, and the ELT buzzer. There is no connection to the aircraft power buses. All power is provided by the ELT internal battery.

System Monitoring

The ELT is monitored by the EICAS and the system CAS message.

FAULT INDICATION

Table 1: Emergency Locator Transmitter – CAS Messages

CAS MESSAGE	LOGIC
ELT ON	ELT transmitting

System Test

Operational Test

The ELT is tested by moving the switch on the remote control panel or the ELT to the ON position. The ELT ON status CAS message is posted after approximately 3 seconds, and the ELT buzzer activates.

CAUTION

The ELT system test should only be performed during the first 5 minutes of the Universal Time Coordinated (UTC) hour. Make sure that the test is not done for more than 15 sec.

INSULATION

(ATA 25-80-00)

OVERVIEW

Thermal insulation controls the rate at which the pressurized area of the aircraft loses heat to the external environment while in flight or on the ground in colder climates. It also controls the rate at which the pressurized area of the aircraft gains heat from the external environment while on the ground in a hotter climate.

Acoustic insulation reduces sound and vibration.

COMPONENTS

The insulation consists of the following components (quantities vary due to interior completion options):

- Bagged thermal insulation
- Acoustic insulation

COMPONENT DESCRIPTION AND LOCATION

Bagged Thermal Insulation

Bagged thermal insulation is composed of Fiberglass batting bagged with AN-18R Orcofilm. Bagged thermal insulation is 10 ±5% larger in length and width than the compartment in which it is installed.

The bagged thermal insulation is located on the:

- Aircraft outer skin's inner side in the pressurized area of the fuselage from left stringer 18 up the side, over the top, and down the side to right stringer 18
- Aft side of the forward bulkhead
- Forward side of the aft bulkhead

Acoustic Insulation

Acoustic insulation provides some thermal resistance to heat transfer, but is mainly used to deaden sound and vibration transfer from aft fuselage.

Acoustic insulation is a 0.25 in. (0.64 cm) foam sheet composed of C-3201-25ALPSA.

The acoustic insulation is bonded on the forward side of the aft bulkhead and located aft of the bagged thermal insulation.

This page intentionally left blank

TABLE OF CONTENTS

INDICATING AND RECORDING
(ATA 31-00-00)
INTRODUCTION 1

DIGITAL DATA BUSES
(ATA 31-01-00)
OVERVIEW 3
Digital Data Buses 3
Associated Data Buses 3
SYSTEM OPERATION 4
HSDB 4
ARINC 429 4
RS-232 4
RS-485/422 4
Controller Area Network 4
ARINC 717 4
Data Bus Operation 4
FAULT INDICATION 5

INSTRUMENT AND CONTROL PANELS
(ATA 31-11-00)
OVERVIEW 9
COMPONENTS 9
COMPONENTS DESCRIPTION AND OPERATION 11
Primary Instrument Panel Assembly 11
Center Pedestal 17
Circuit Breaker Panels 22

FLIGHT DATA RECORDER
(ATA 31-30-00)
OVERVIEW 23
COMPONENTS 23
COMPONENT DESCRIPTIONS 23
Flight Data Recorder 23
Inertia Switch 25
Accelerometer 26
SYSTEM OPERATION 27
FAULT INDICATION 28

SECURE DIGITAL CARDS
(ATA 31-40-00)
OVERVIEW 29
COMPONENT 29
COMPONENT DESCRIPTION AND OPERATION 29
SD Cards 29
G5000 - GDU SD Cards 29
SYSTEM OPERATION 32
DATABASES 32
Basemap 34
Terrain and Airport Terrain 34
Obstacle 34
SafeTaxi 34
Jeppesen ChartView 34
Jeppesen Navigation Database 34
Airport Directory Database 35
Additional SD Card Files 35
Electronic Checklists 35
OEM Diagnostics 35
Database Expiration Information 36
FAULT INDICATION 37

CENTRAL COMPUTING SYSTEM
(ATA 31-41-00)
OVERVIEW 39
COMPONENTS 39
Associated Components 39
COMPONENT DESCRIPTIONS 39
Integrated Avionics Unit (GIA) 39
SYSTEM OPERATION 40
FAULT INDICATION 42

ENGINE INDICATING AND CREW ALERTING SYSTEM
(ATA 31-51-00)
OVERVIEW 43
COMPONENTS 43
Associated Components 43
COMPONENT DESCRIPTIONS 43
Engine and Airframe Interface Units 43
Serial Data Concentrator Units 43
WARN/CAUT Switch/Annunciators 44

Integrated Avionics Units 47
Display Units (DU1, DU2, and DU3) 47
Engine Signal Conditioners 48
Audio Processors 48
CONTROLS AND INDICATIONS 49
SYSTEM OPERATION 51
EICAS Display 51
CREW ALERTING SYSTEM 55
Visual Alerts 55
Aural Alerts 56
CAS Message Inhibit Modes 58

CONFIGURATION MONITOR SYSTEM (ATA 31-53-00)
OVERVIEW 63
Associated Components 63
SYSTEM OPERATION 63

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (ATA 31-60-00)
OVERVIEW 67
COMPONENTS 67
Associated Components 67
COMPONENT DESCRIPTION 69
Display Units 69
Touch Controllers 71
Remote Controllers 74
DU Reversion/Dimming Panel 76
Integrated Avionics Units 76
P11 Panel 76
SYSTEM OPERATION 77
SYSTEM INTERFACE 85
Interfaces 85
Power 87
FAULT INDICATION 89

This page intentionally left blank

INDICATING AND RECORDING

(ATA 31-00-00)

INTRODUCTION

The Learjet 70/75 aircraft uses the Garmin G5000 Integrated Avionics System to display digital flight information.

This chapter is comprised of systems and components which provide equipment malfunction warnings, visual and/or aural indications of unsafe conditions, and indications that some systems are in operation.

The chapter is subdivided in the following eight sections:

- Digital data buses ATA 31-01-00
- Instrument and control panels ATA 31-11-00
- Flight data recorder system ATA 31-30-00
- SD card ATA 31-40-00
- Central computing ATA 31-41-00
- Engine indicating and crew alerting system ATA 31-51-00
- Configuration monitoring system ATA 31-53-00
- Electronic flight instrument system (EFIS) ATA 31-60-00

This page intentionally left blank

DIGITAL DATA BUSES

(ATA 31-01-00)

OVERVIEW

The Bombardier Vision Flight Deck in the Learjet 70/75 primarily consists of the Garmin G5000 integrated avionics system.

The system architecture for the G5000 system utilizes HSDB protocol as the primary communication protocol within the system. The use of the HSDB protocol provides significant flexibility and expandability, high integrity and the capability for high redundancy.

The flexibility of the design allows additional data paths and LRUs to be added and selectively rearranged based on system configuration and functional hazard assessment classifications. The architecture allows optional equipment to be populated with minimal impact to the harness.

Digital Data Buses

Figure 1

The various LRUs in the system interface with each other, using five main communication protocols:

- HSDB
- ARINC 429
- RS-232
- RS 485/422
- Controller area network (CAN) protocol

Associated Data Buses

- ARINC 717

SYSTEM OPERATION

HSDB

High-speed data bus (HSDB) is used in the G5000 to provide upper level communication capabilities, with point-to-point, full duplex channels capable of 10 megabits/sec data rates. This protocol was designed to give the required integrity and functionality with minimal additional overhead found in other more standard higher level Ethernet communication protocols, and provides guaranteed delivery of asynchronous packets through an acknowledge protocol. HSDB requires a full duplex point-to-point network connection between HSDB ports.

By using full duplex, packet collisions are not an issue on this network. HSDB networks use twisted copper pairs for Transmit (TX) and Receive (RX) to provide full duplex point-to-point connections on a 10Mbps Ethernet network.

ARINC 429

The G5000 system uses unidirectional high-speed and low-speed ARINC 429 communication with parity integrity check. G5000 ARINC 429 data complies with the ARINC specification.

RS-232

The G5000 system uses unidirectional or bidirectional configurable baud rate communication channels. RS-232 is predominately used in the G5000 for system code uploads. Additionally, RS-232 is used within the integrated avionics unit to provide communication between the main subsystem and other sensors such as the COM, G/S, GPS, and VOR/LOC.

RS-485/422

The G5000 system uses RS-485 as a bidirectional communication channel and RS-422 as a unidirectional communication channel.

Controller Area Network

The G5000 uses the controller area network (CAN) protocol to allow integrated avionics unit 1 and integrated avionics unit 2 to communicate between each other if the primary HSDB connection into the system is not available.

ARINC 717

ARINC 717 is a protocol that is used exclusively for the flight data recorder. Continuous data streams are sent out and are encoded into frames. Snapshots of the aircraft systems are created and recorded. See ATA 31-30-00 FDR for more information.

Data Bus Operation

The G5000 system is a highly integrated system with primary functions distributed throughout various line replaceable units (LRUs) within the system. Large amounts of analog and digital data is received, collected, and converted by those LRUs for final destination onto the HSDB where it becomes integrated into the system for display, control, and monitoring.

FAULT INDICATION

CAS MESSAGE	LOGIC & APPLICABLE BUSES	
DATABUS FAIL	A data bus has failed and the aircraft is on the ground. A failure has occurred in one or more of the applicable buses:	
	HSDB Bus From GIA1 to DU1 HSDB Bus From GTC1 to DU1 HSDB Bus From GSD1 to DU1 HSDB Bus From GTC1 to DU2 HSDB Bus From GTC2 to DU2 HSDB Bus From GSD2 to DU2 HSDB Bus From GIA2 to DU3 HSDB Bus From GTC2 to DU3 HSDB Bus From DU1 to DU3 HSDB Bus From DU3 to DU1 HSDB Bus From GSD2 to DU3 HSDB Bus From GSD1 to GSD2 RS232 Bus to GIA1 from ADC1 RS232 Bus to GIA1 from AHRS1 RS485 Bus to GIA1 from GEA1 RS485 Bus to GIA1 from GEA2 ARINC-429 Bus to GIA1 from AHRS2 ARINC-429 Bus to GIA1 from ADC2 ARINC-429 Bus to GIA1 from ADC1 ARINC-429 Bus to GIA1 from AHRS1	RS232 Bus to GIA2 from ADC2 RS232 Bus to GIA2 from AHRS2 RS485 Bus to GIA2 from GEA1 RS485 Bus to GIA2 from GEA2 ARINC-429 Bus to GIA2 from AHRS1 ARINC-429 Bus to GIA2 from ADC1 ARINC-429 Bus to GIA2 from, ADC2 ARINC-429 Bus to GIA2 from AHRS2 RS232 Bus to DU1 from GCU1 ARINC-429 Bus to DU1 from AHRS1 RS232 Bus to DU2 from GCU2 RS232 Bus to DU2 from GCU1 ARINC-429 Bus to DU2 from AHRS1 ARINC-429 Bus to DU2 from ADC1 RS232 Bus to DU3 from GCU2 ARINC-429 Bus to DU3 from AHRS2 RS485 Bus to GSD1 from GEA3 RS485 Bus to GSD1 from GEA4 RS485 Bus to GSD2 from GEA3 RS485 Bus to GSD2 from GEA4

CAS MESSAGE	LOGIC & APPLICABLE BUSES (CONTINUED)	
DATABUS FAIL	A data bus has failed and the aircraft is in the air. A failure has occurred in one or more of the applicable buses:	
	HSDB Bus From GIA1 to DU1 HSDB Bus From GTC1 to DU1 HSDB Bus From GSD1 to DU1 HSDB Bus From GTC1 to DU2 HSDB Bus From GTC2 to DU2 HSDB Bus From GSD2 to DU2 HSDB Bus From GIA2 to DU3 HSDB Bus From GTC2 to DU3 HSDB Bus From DU1 to DU3 HSDB Bus From DU3 to DU1 HSDB Bus From GSD2 to DU3 HSDB Bus From GSD1 to GSD2 RS232 Bus to GIA1 from ADC1 RS232 Bus to GIA1 from AHRS1 RS485 Bus to GIA1 from GEA1 RS485 Bus to GIA1 from GEA2 ARINC-429 Bus to GIA1 from AHRS2 ARINC-429 Bus to GIA1 from ADC2 ARINC-429 Bus to GIA1 from ADC1 ARINC-429 Bus to GIA1 from AHRS1	RS232 Bus to GIA2 from ADC2 RS232 Bus to GIA2 from AHRS2 RS485 Bus to GIA2 from GEA1 RS485 Bus to GIA2 from GEA2 ARINC-429 Bus to GIA2 from AHRS1 ARINC-429 Bus to GIA2 from ADC1 ARINC-429 Bus to GIA2 from ADC2 ARINC-429 Bus to GIA2 from AHRS2 RS232 Bus to DU1 from GCU1 ARINC-429 Bus to DU1 from AHRS1 RS232 Bus to DU2 from GCU2 RS232 Bus to DU2 from GCU1 ARINC-429 Bus to DU2 from AHRS1 ARINC-429 Bus to DU2 from ADC1 RS232 Bus to DU3 from GCU2 ARINC-429 Bus to DU3 from AHRS2 RS485 Bus to GSD1 from GEA3 RS485 Bus to GSD1 from GEA4 RS485 Bus to GSD2 from GEA3 RS485 Bus to GSD2 from GEA4
DATABUS FAULT	Displayed when data path errors exist and the aircraft is on the ground This message is triggered when one or more of the applicable buses fails:	
	RS232 Bus #1 from the Brake Control Unit (maintenance data) to GIA1 RS232 Bus #2 from the Brake Control Unit (maintenance data) to GIA1 ARINC-429 from ESIS to GIA1 RS232 from GMC to DU1 RS232 from GMC to DU3 RS422 RCV Bus #1 from the Nose Wheel Steering Computer (maintenance data) to GSD1 RS422 RCV Bus #2 from the Nose Wheel Steering Computer (maintenance data) to GSD1	RS422 RCV Bus from the Flap Computer (maintenance data) to GSD1 ARINC-429 from L DEEC to GSD1 ARINC-429 from R DEEC to GSD1 RS485 from GTS to GSD2 ARINC-429 from L DEEC to GSD2 ARINC-429 from R DEEC to GSD2 HSDB from GTS to GSD1 RS 422 from Spoiler Computer to GSD 2 (maintenance bus)

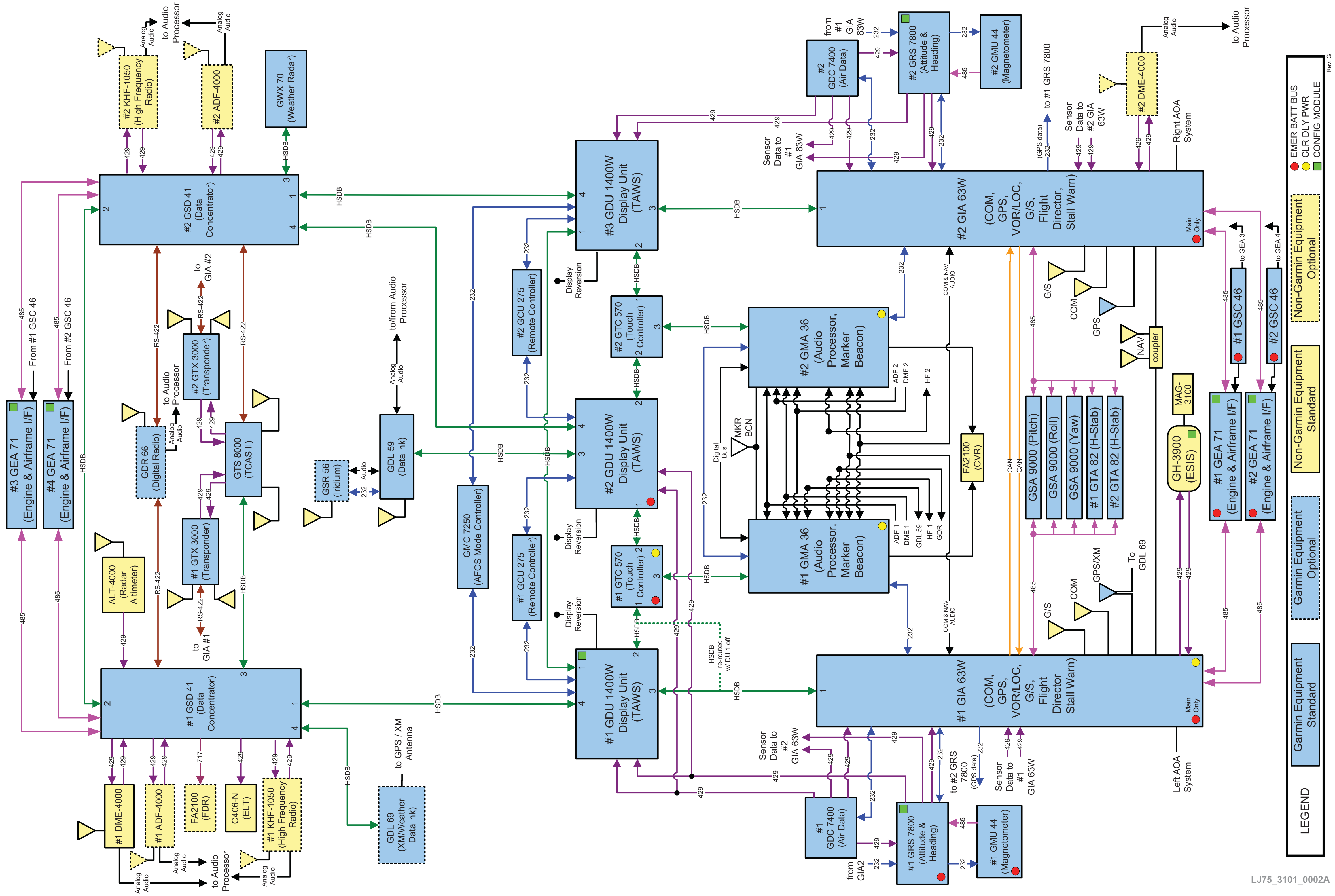


Fig. 1: System Overview

This page intentionally left blank

INSTRUMENT AND CONTROL PANELS

(ATA 31-11-00)

OVERVIEW

Instrument and control panels consist of systems and components that visually indicate flight conditions.

COMPONENTS

Figure 2

The instrument and control panels include the following assemblies:

- Primary instrument panel assembly
- Center pedestal assembly
- Circuit breaker panel assemblies (2)

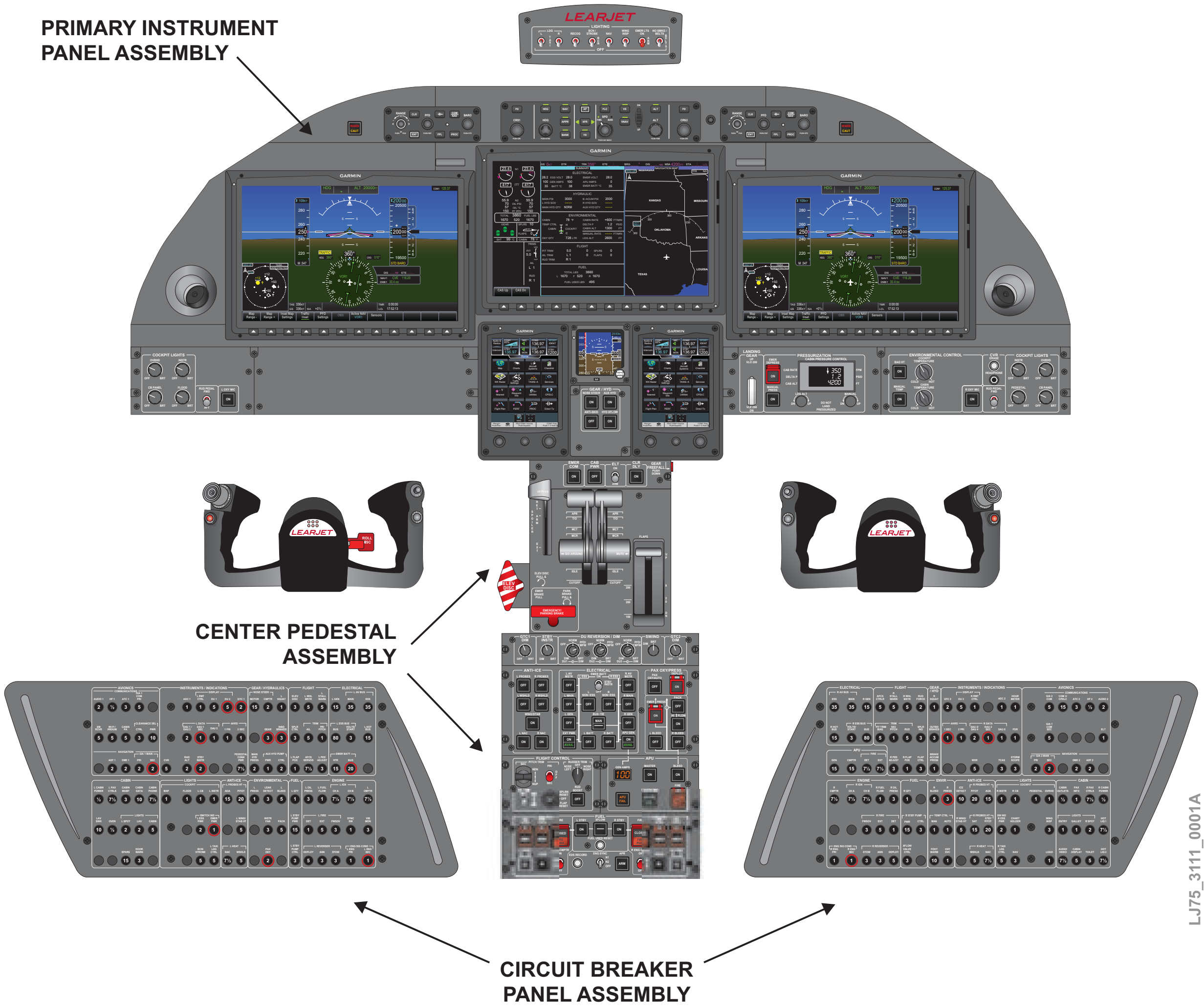


Fig. 2: LR75 Cockpit Panels – General Arrangement

COMPONENTS DESCRIPTION AND OPERATION

Primary Instrument Panel Assembly

Figure 3

The primary instrument panel assembly consists of the following four sections:

- Overhead switch panel
- Glareshield panel assembly
- Instrument panel assembly
- Switch panel assemblies

Fig. 3: Primary Instrument Panel Assembly

Overhead Switch Assembly

Figure 4

The overhead switch panel consists of the lighting panel.

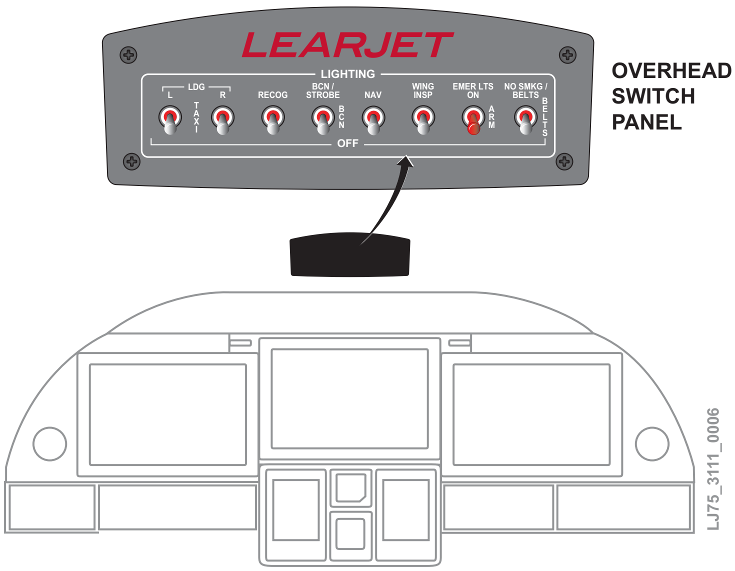


Fig. 4: Overhead Switch Assembly

Glareshield Assembly

Figure 5

The glareshield assembly consists of the following components:

- WARN/CAUT switch/annunciators (2)
- Remote controllers (2)
- Autopilot mode controller
- Area microphone

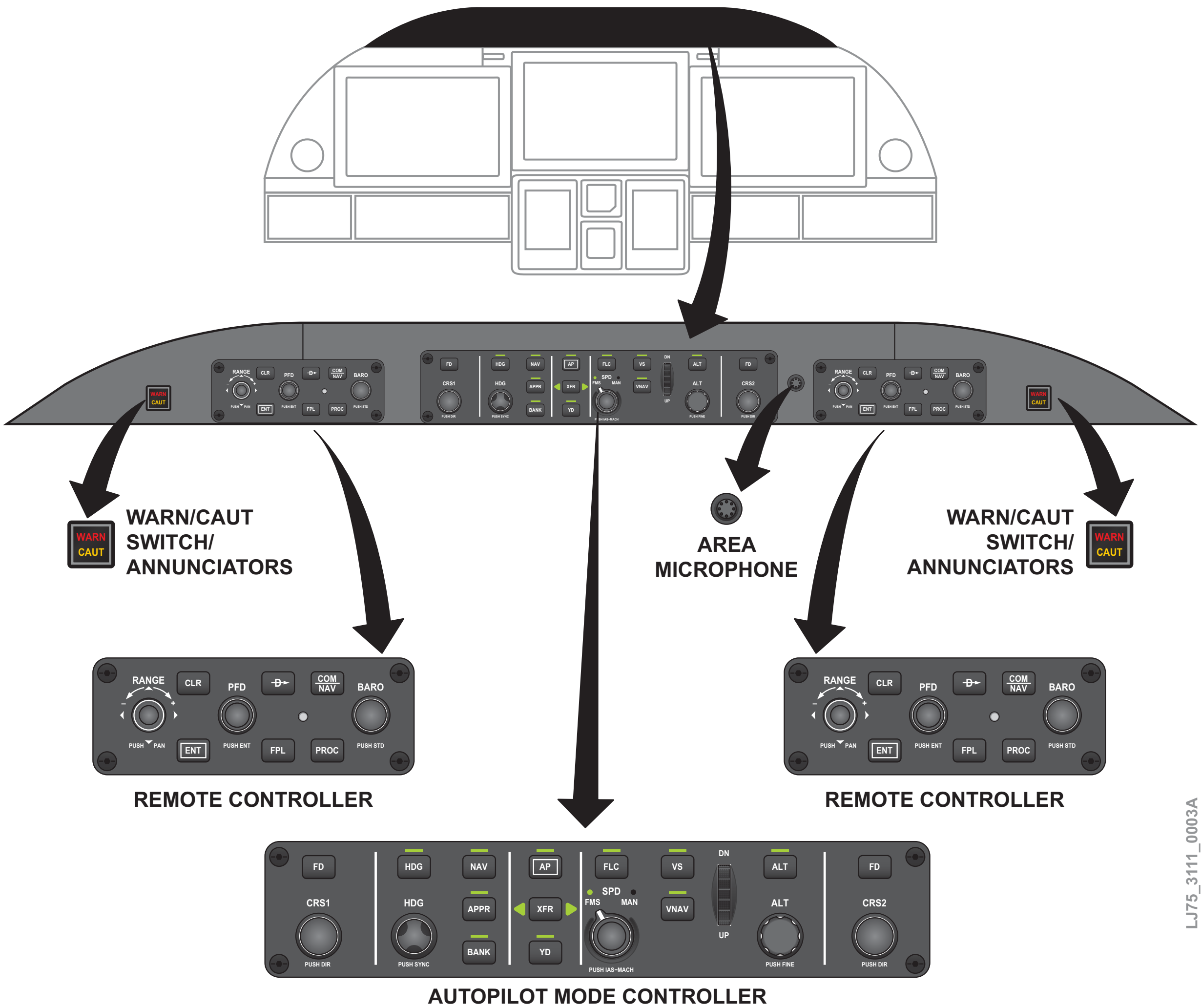


Fig. 5: Glareshield Assembly

Instrument Panel Assembly

Figure 6

The instrument panel assembly is divided into the following three sections:

- Pilot display unit (DU1)
- Center display unit (DU2)
- Copilot display unit (DU3)

The lower section consists of the following components:

- Pilot touch controller (GTC1)
- Gear/hydraulic panel
- Electronic standby instrument system (ESIS)
- Copilot touch controller (GTC2)

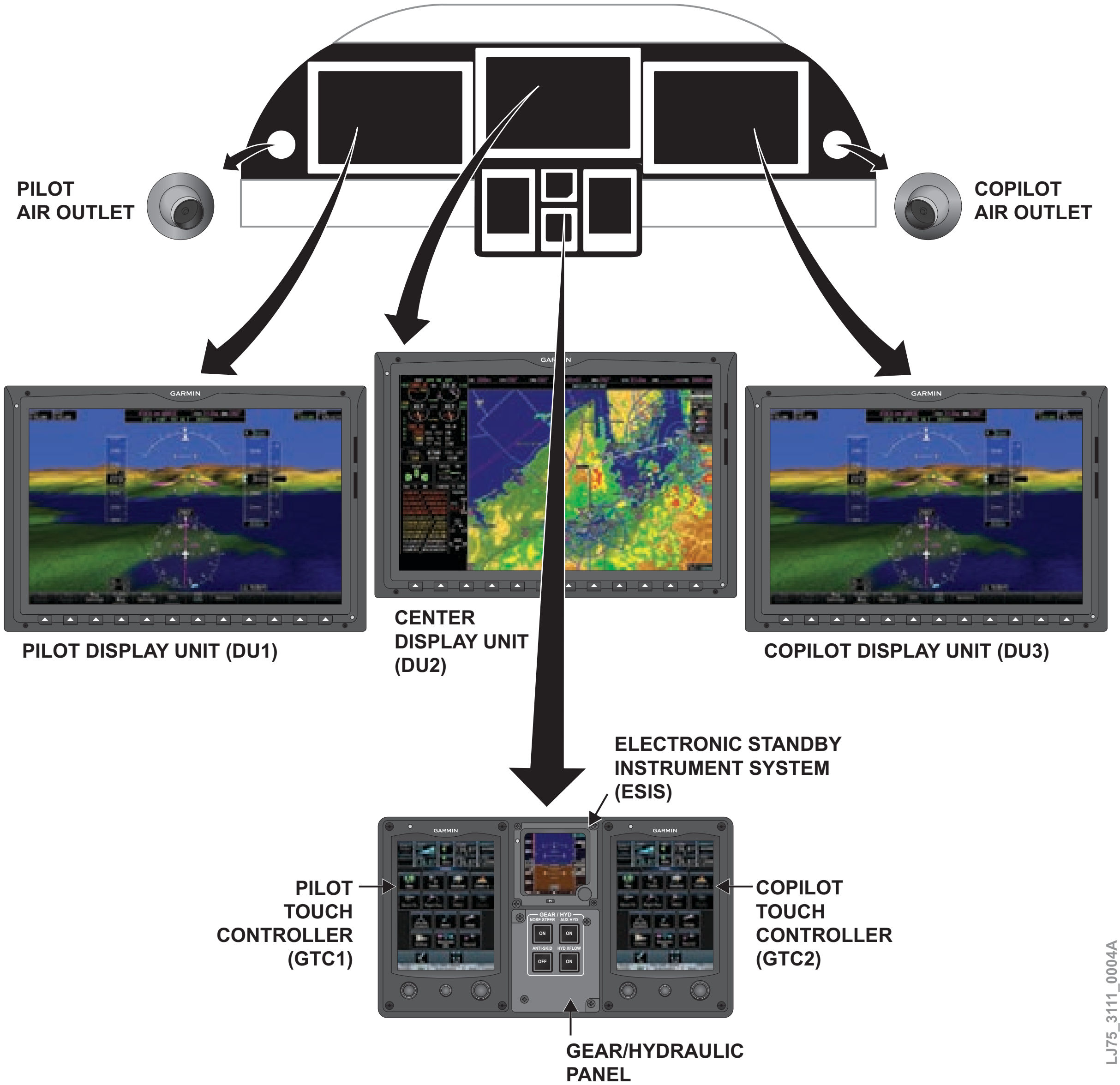


Fig. 6: Instrument Panel Assembly

Switch Panel Assemblies

Figure 7

The switch panel assemblies consists of the following components:

- Pilot cockpit lighting
- Pilot rudder pedal adjustment
- Pilot oxygen mic switch
- Landing gear control panel
- Cabin pressurization control panel
- Environmental control panel
- Copilot oxygen mic switch
- Cockpit voice recorder panel
- Copilot rudder pedal adjustment
- Copilot cockpit lighting

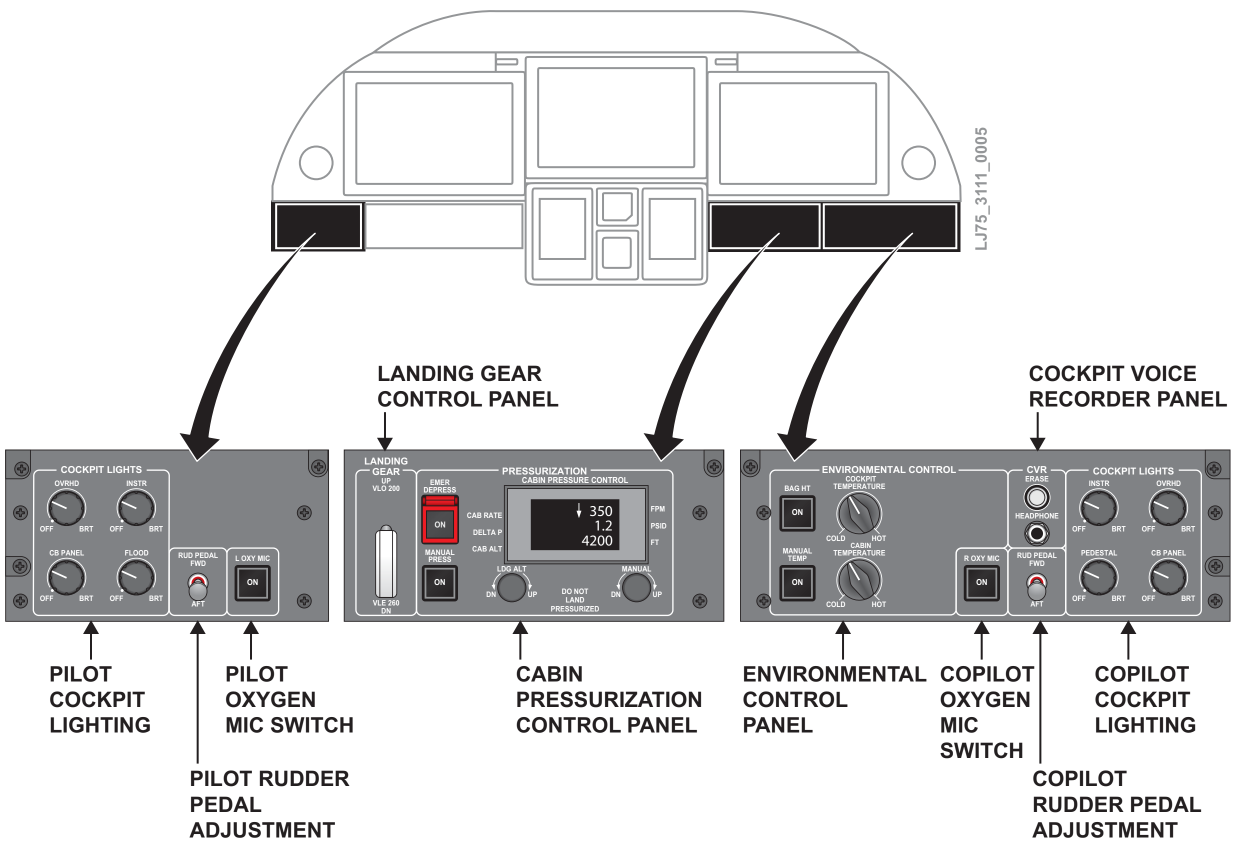


Fig. 7: Switch Panel Assembly

Center Pedestal

Figure 8

The center pedestal consists of the following sections:

- Forward pedestal and quadrant section
- Aft pedestal section

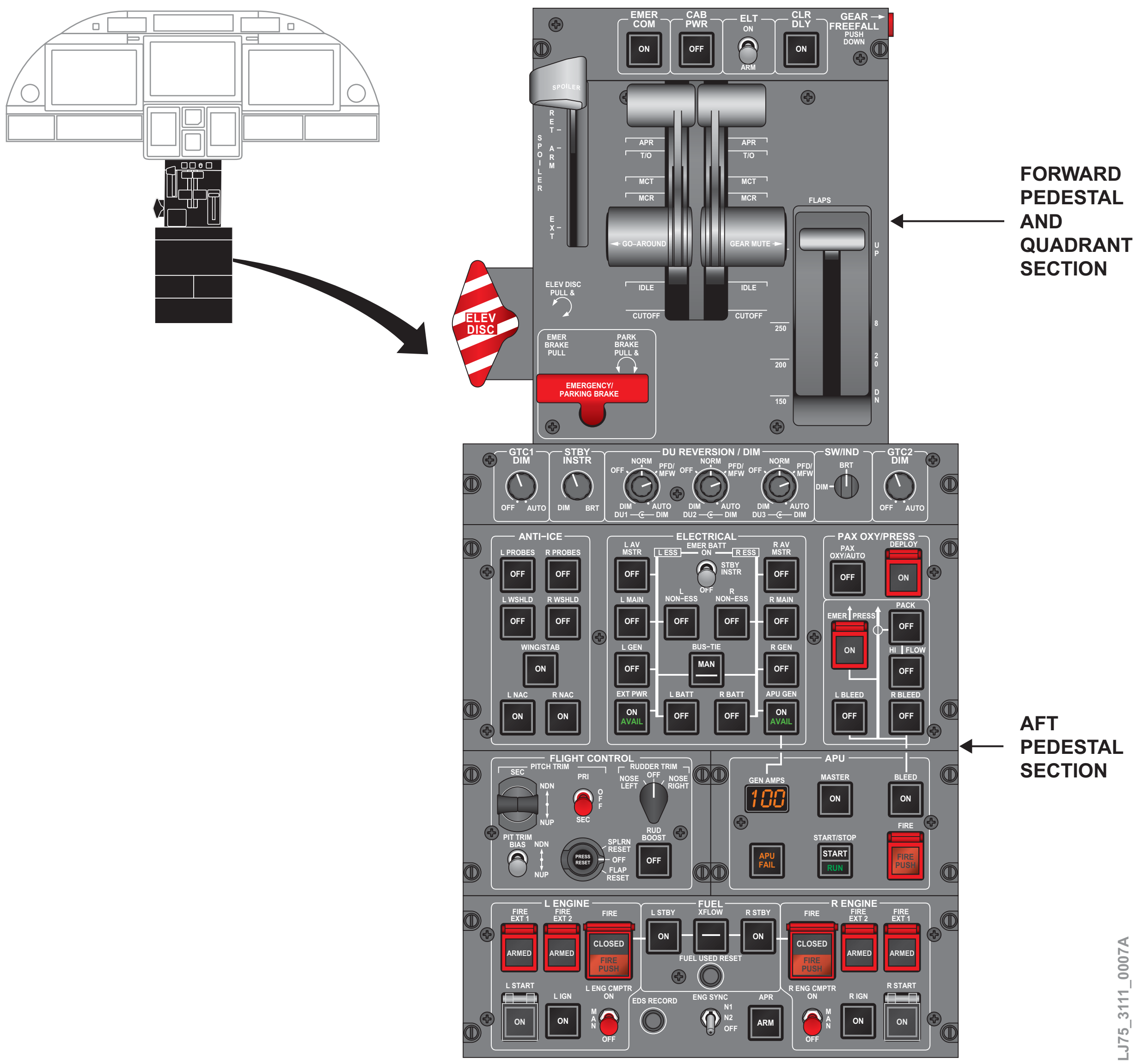


Fig. 8: Center Pedestal

Forward Pedestal and Quadrant Section

Figure 9

The forward pedestal and quadrant section consists of the following components:

- Emergency parking brake handle
- Elevator Disconnect Handle
- Thrust levers
- Spoiler lever
- EMER COM switch
- Cabin power switch
- ELT switch
- Clearance delivery switch
- Gear freefall lever
- Thrust reverser levers
- Flap lever

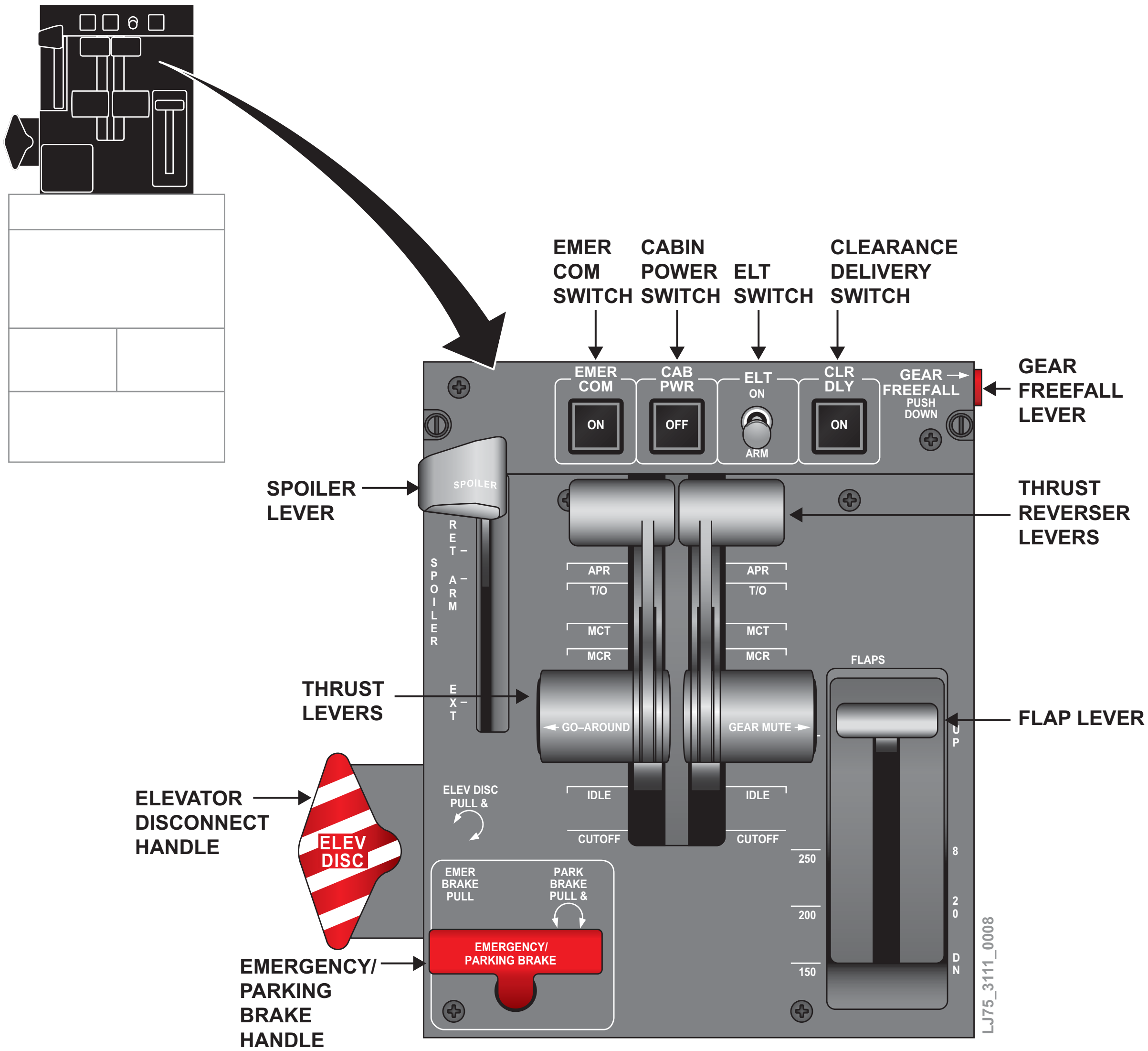


Fig. 9: Forward Pedestal and Quadrant

Aft Pedestal

Figure 10

The aft pedestal section consists of the following components:

- Left engine control panel
- Flight control panel
- Anti-ice panel
- Electrical control panel
- Pilot touch controller dimmer
- Standby instrument (ESIS) dimmer
- Display unit (DU) reversion/dimmer panel
- Switch/indicator dimmer
- Copilot touch controller dimmer
- Passenger oxygen controls
- Bleed air controls
- APU control panel
- Fuel control panel
- Right engine control panel
- Engine automatic performance reserve (APR) switch
- Engine sync switch
- Engine diagnostic system (EDS) record switch

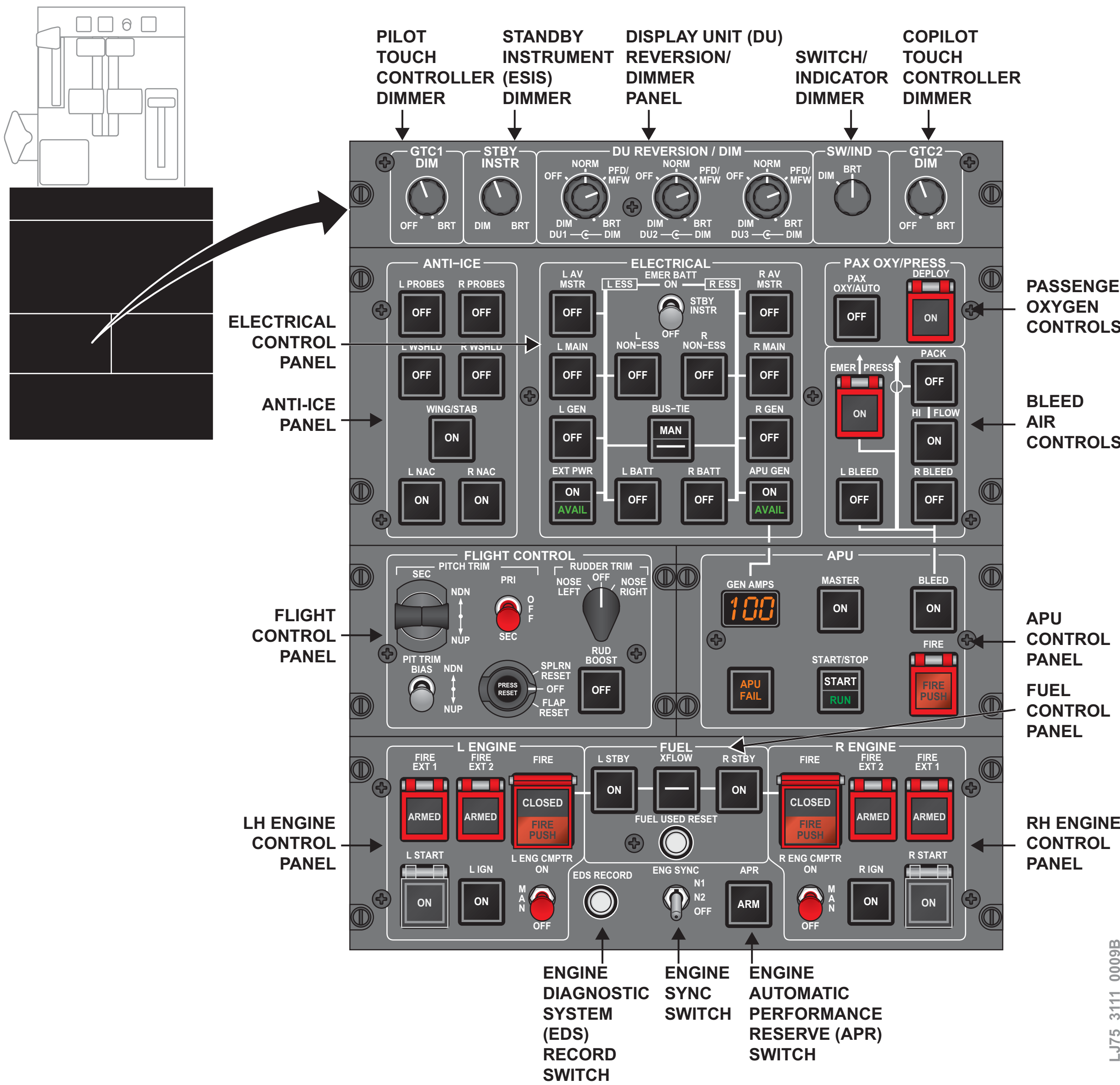


Fig. 10: Aft Pedestal

Circuit Breaker Panels

Figure 11

One circuit breaker panel is located on the pilot outboard wall and one on the copilot outboard wall. For more details, refer to ATA 24-60-00 Electrical Power.

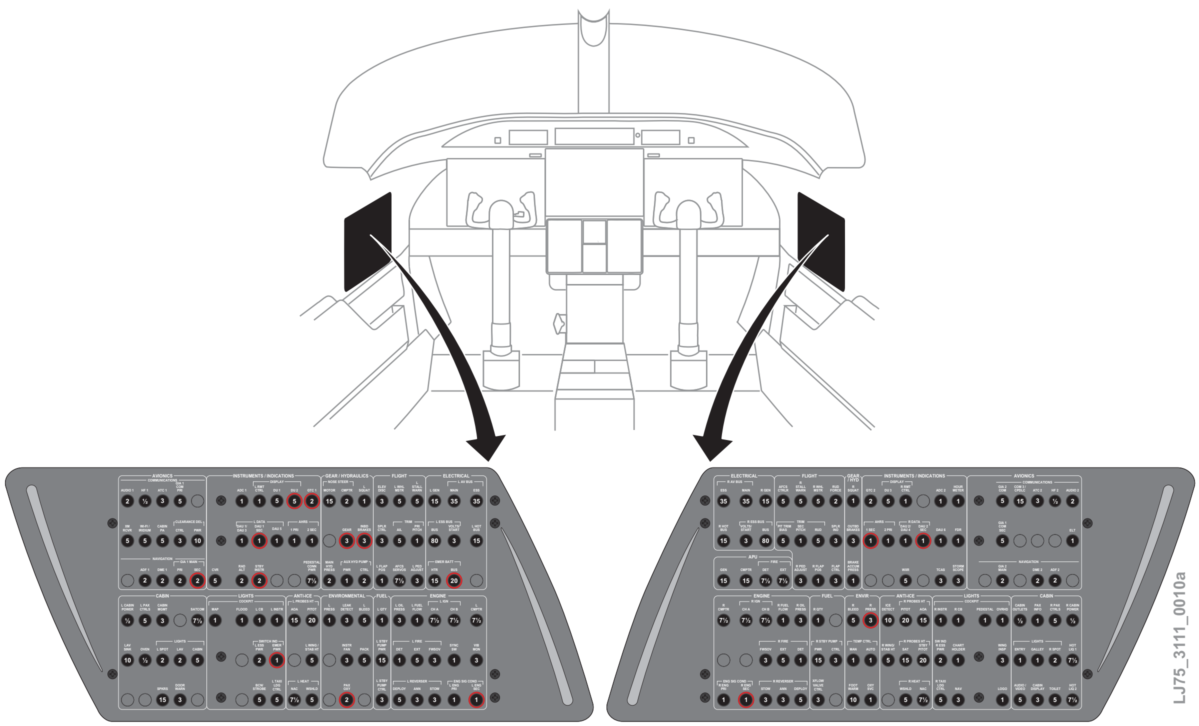


Fig. 11: Circuit Breaker Panel

FLIGHT DATA RECORDER

(ATA 31-30-00)

OVERVIEW

The flight data recorder (FDR) system records a number of aircraft flight parameters. It uses solid-state memory to monitor real-time flight data and store it in non-volatile memory. The recorded data can be removed from the recorder and used in incident or accident investigation.

COMPONENTS

The flight data recording system consists of the following components:

- FDR
- Inertia switch
- FDR accelerometer

COMPONENT DESCRIPTIONS

Flight Data Recorder

Figure 12

The FDR, located in the aft equipment compartment, is contained in a standard, international orange, stainless steel case with reflective striping and raised lettering. The FDR has an operating range of -1000 to +55,000 ft, and contains an internal built-in-test (BIT) that avoids the need for preflight testing.

The FDR consists of:

- Chassis and front panel
- Two printed wiring assemblies (aircraft interface and acquisition processor)
- Crash survivable memory unit (CSMU)

The CSMU contains the solid state flash memory used as the recording medium. An underwater locator device (ULD), also referred to as an underwater acoustic beacon, is mounted horizontally on the front of the CSMU and is also used as a carrying handle for the recorder.

The ULD is a battery operated, underwater acoustic pulse generator. The ULD consists of a water switch, a battery, an oscillator, and a piezoelectric ceramic transducer. When the water switch is wet, the battery supplies power to the oscillator, which causes the electromagnetic transducer to send out a 36.5- to 38.5-kHz signal.

The signal transmits for a minimum of 30 days at a range of 2000 to 4000 yards (1800 to 3600 m). The ULD is resistant to deep-sea depths of 20,000 ft (6096 m). The lithium battery must be replaced every 6 years.

The ground support equipment (GSE) connector is located on the front of the FDR. This connector provides the interface from the FDR to GSE for checkout of the FDR or to transfer data to a readout or analysis device.

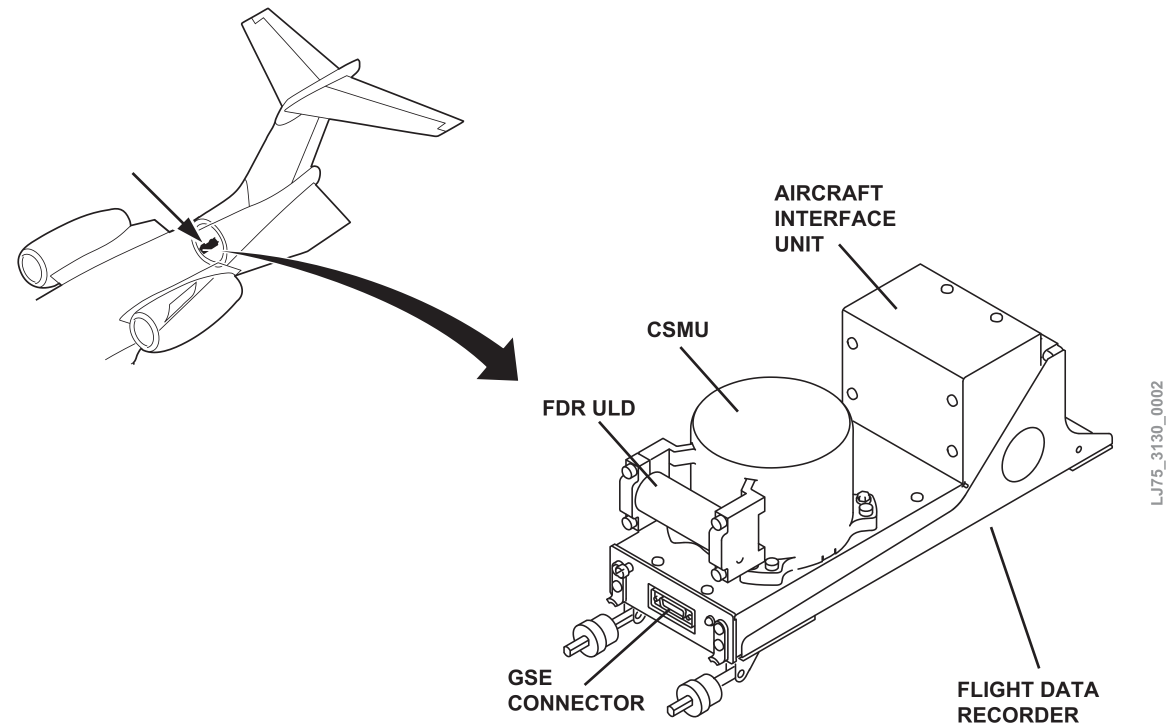


Fig. 12: Flight Data Recorder

Inertia Switch

Figure 13

The inertia switch is located behind the toilet in the lavatory. The switch interrupts power to the FDR in the event of a crash.

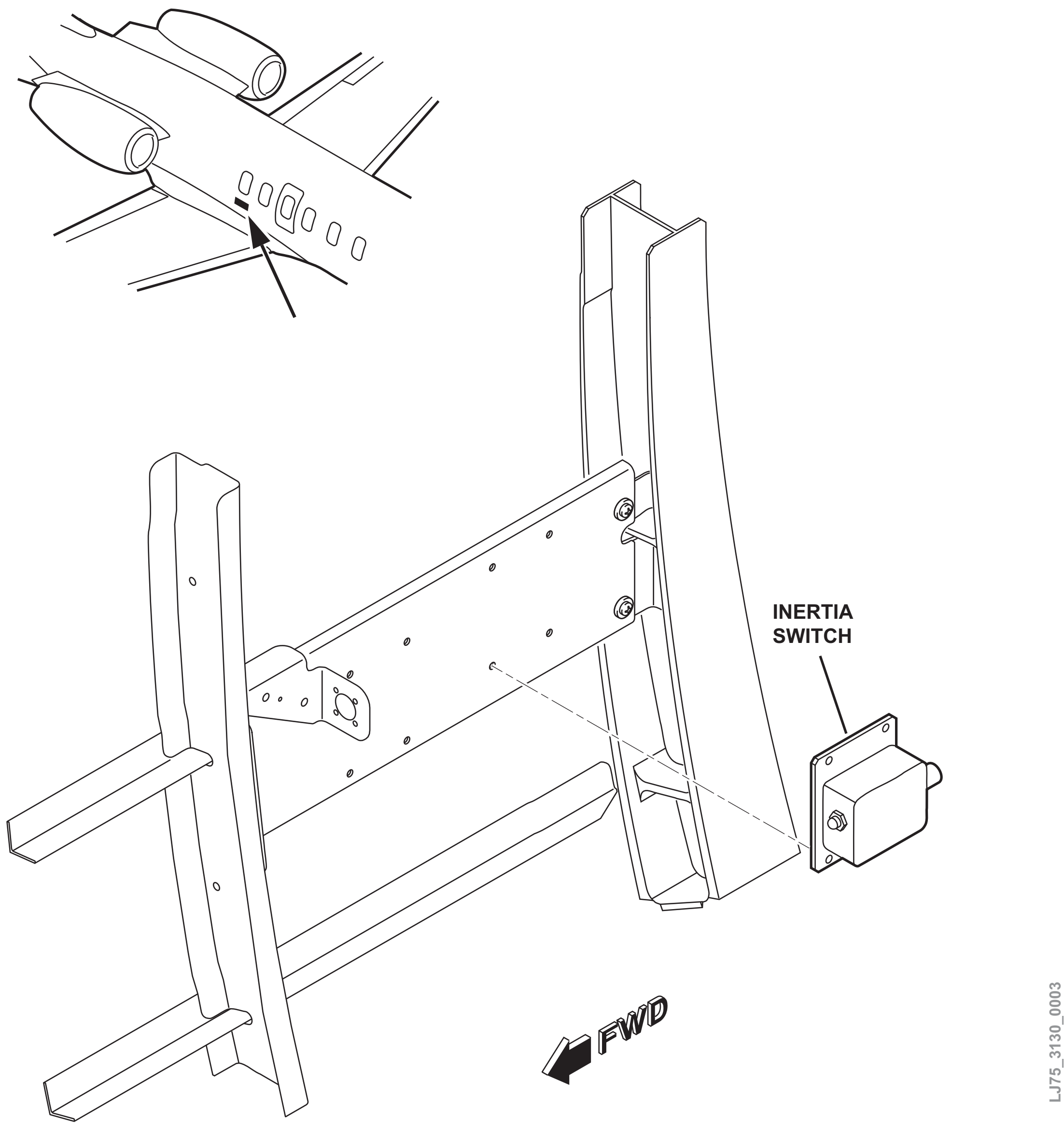


Fig. 13: Inertia Switch

Accelerometer

Figure 14

The accelerometer is located at BL 0.00 at the top of the aft pressure bulkhead, and is a hermetically sealed instrument that contains three separate accelerometers. The accelerometer measures the rates on three axes near the aircraft center of gravity, simultaneously measuring vertical, lateral, and longitudinal acceleration. The acceleration data is supplied to the engine and airframe interface unit no. 3 engine and airframe interface unit to augment the flight data parameters recorded on the FDR.

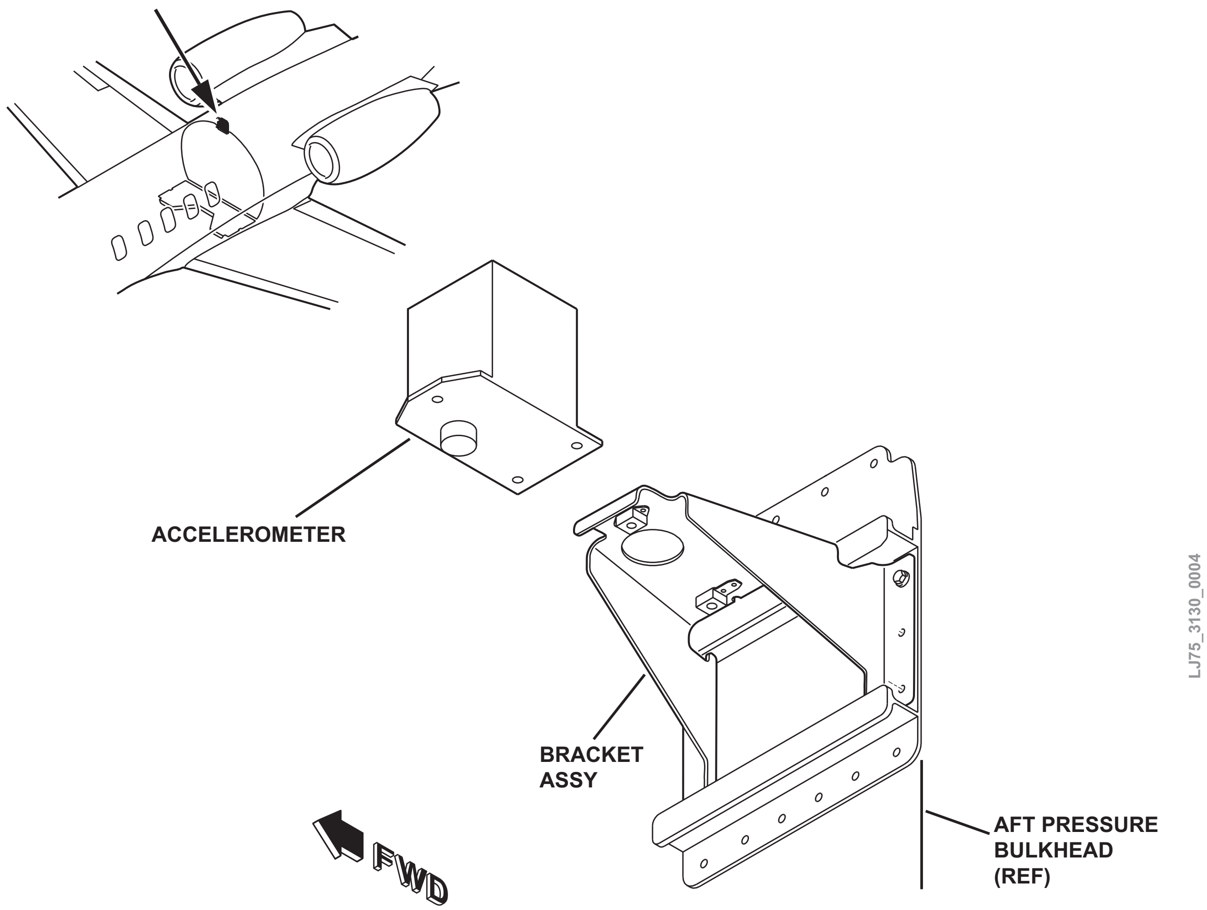


Fig. 14: Accelerometer

SYSTEM OPERATION

Figure 15

Power is supplied to the FDR through a circuit breaker on the right essential bus. When power is first applied, the FDR performs a self-test and the EICAS message FDR FAIL is displayed for about 5 seconds. A test pass causes the message to go off and remain off. After power is applied, the FDR stores the aircraft flight data received from the data concentrator no 1 in memory.

The FDR continuously records selected input data into a solid state memory. The data recorder has sufficient storage capacity to record the last 25 hours of flight history. After 25 hours of operation, the recorder will automatically start recording over previously recorded material.

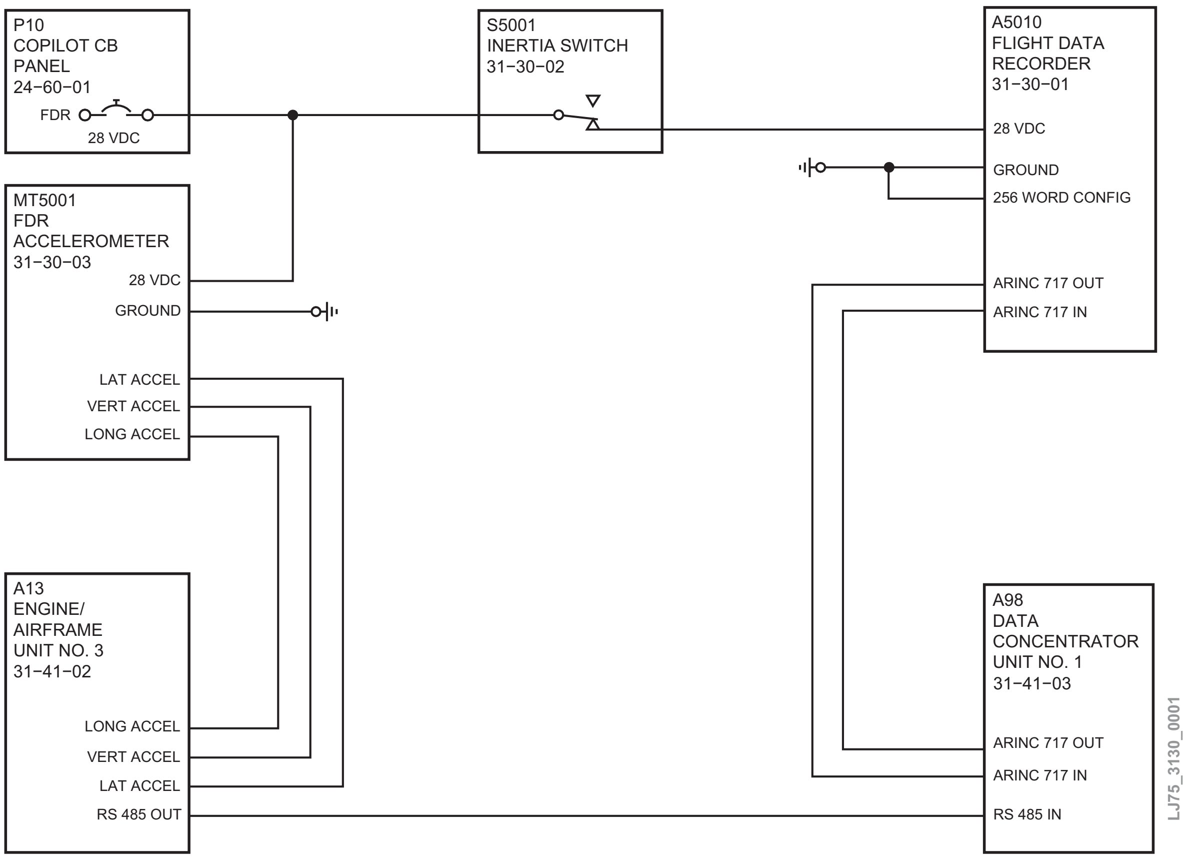


Fig. 15: FDR System Block Diagram

Engine and airframe unit no. 3 receives lateral, longitudinal, and vertical acceleration input from the FDR accelerometer. The engine and airframe unit sends the accelerometer outputs to data concentrator no. 1. Data concentrator no. 1 processes, formats, and transmits flight data to the FDR though an ARINC 717 data bus.

Internal circuitry disables the recording function after 8 to 10 minutes in the event powered flight is no longer sustained. On the ground, the data can be removed from the FDR with a portable analysis unit (PAU) through an electrical test connector on the front of the recorder. The PAU copies real-time data as well as recorded data. The same connector connects to equipment for automatic testing of the FDR.

FAULT INDICATION

Table 1: Flight Data Recorder – CAS Message

CAS MESSAGE	LOGIC
FDR FAIL	Indicates a fault with the flight data recorder

The white FDR FAIL advisory message indicates a fault with the flight data recorder. During powerup, the FDR fail indication should go out within 5 seconds. During the initial powerup, a system BIT check performs recorder system tests in 5 seconds. Then, ARINC 573 information from the flight data acquisition unit is checked, which can take up to 120 seconds. The FDR FAIL discrete is a signal that drives this CAS message directly.

SECURE DIGITAL CARDS

(ATA 31-40-00)

OVERVIEW

The avionics system uses secure digital (SD) cards to store information used during normal operation and to upload and download data to the G5000 system.

The database is used to provide the avionics updates for information that changes more frequently than the software. Some databases may have some limitations or restrictions.

COMPONENT

- SD Cards

COMPONENT DESCRIPTION AND OPERATION

Figure 17

SD Cards

Each display has secure digital (SD) card slots in the top right portion of the display bezels. SD cards are used for various functions, including:

- Top Slot
  - Software and configuration uploads, navigation database uploads, flight plan upload/download, fixed content data logging, retrieval of data logged within the GDU, checklist file (if installed)
  - The SD card in the top slot can remain during normal operation or can be removed after use, depending on the specific functions that are being performed (e.g. for fixed-content data logging the card would remain in the top slot of the MFD; for software or configuration upload the card would be removed after the upload is complete)
- Bottom Slot
  - Storage of all system databases excluding the navigation database
  - The bottom SD card remains in each display during normal operation

Not all SD cards are compatible with the system. Use only SanDisk SD cards.

G5000 - GDU SD Cards

Figure 16

- Aircraft System Software Loader card (1)
- Jeppesen Navigation Database (1)
- Supplemental Database Card (3)
  - Terrain (-43 Terrain supports SVS)
  - Obstacles
  - ChartView/FliteCharts (MFD) optional
  - High Resolution Basemap
  - Checklist
  - SafeTaxi

Four different cards used in G5000 installations:

- System software loader card
- Feature enablement card
- NAVDATA card
- Supplemental database card

NOTE

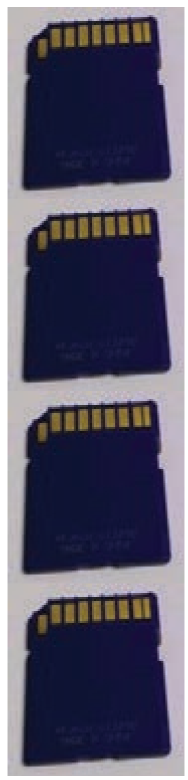
When either the Feature Enablement card or Supplemental Database cards are installed in a GDU, the System ID is written on the card. Once the System ID is written on the card that card will only ever work on THAT specific aircraft.

Aircraft System Software Loader card (Qty1)

Jeppesen Navigation Database (Qty1)

Supplemental Database Card (Qty3)
1. Terrain (43 Terrain supports SVS)
2. Obstacles
3. ChartView/FliteCharts (MFD) optional
4. High Resolution Basemap
5. Checklist
6. SafeTaxi

Four Different Cards Used in G5000 Installations:



System Software Loader Card

Feature Enablement Card

NAVDATA Card

Supplemental Database Card

LJ75_3140_0005

Fig. 16: G5000 - GDU SD Cards

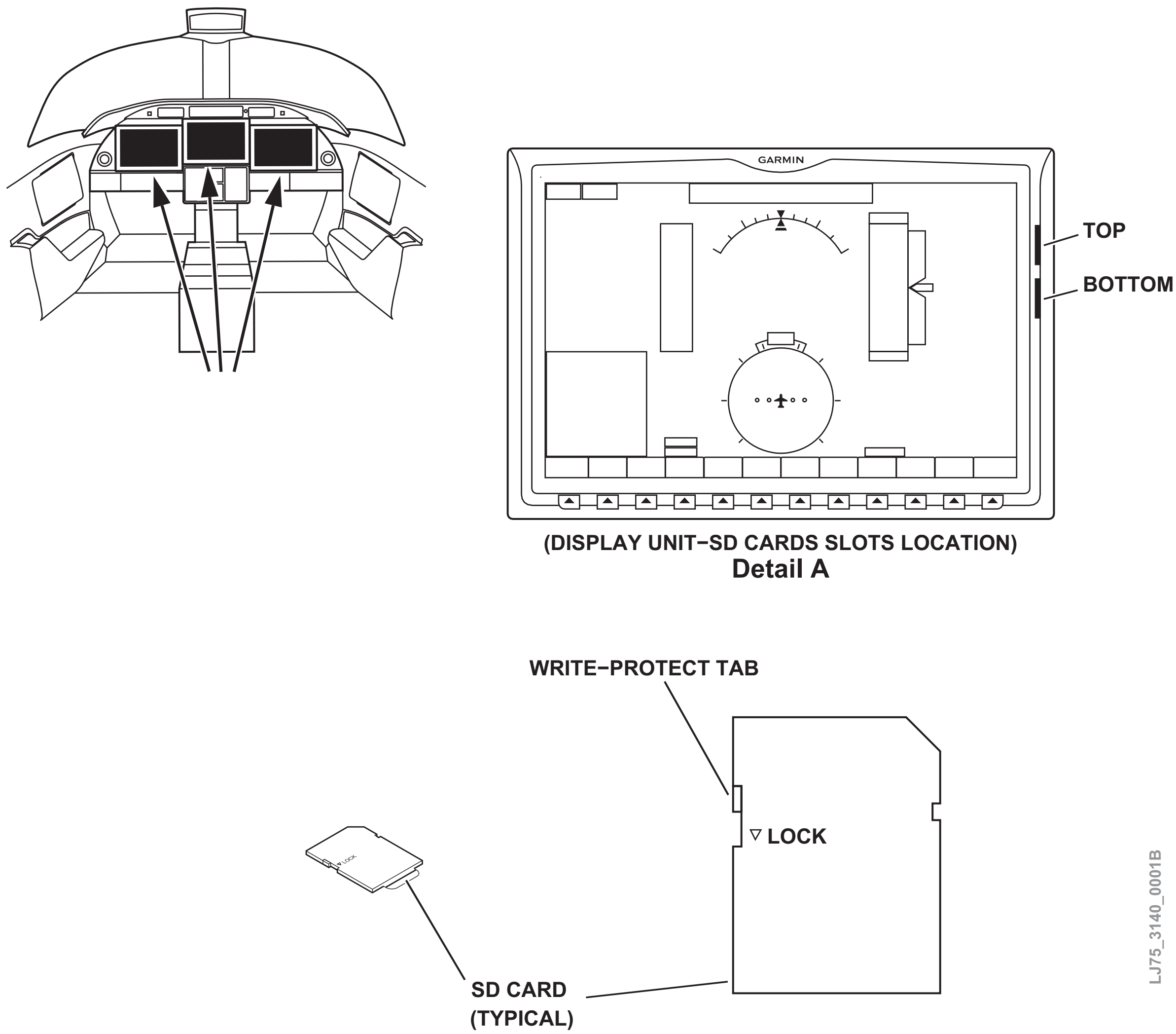


Fig. 17: Secure Digital Card Location

SYSTEM OPERATION

Each GDU has secure digital (SD) card slots in the right portion of the display bezels.SD cards are used for various functions, including:

- Top slot—Software and configuration uploads, navigation database uploads, flight plan upload/download, fixed content data logging, retrieval of data logged within the GDU
- Bottom slot—Storage of all system databases, excluding navigation database

The SD cards in the top DU slots are used to install software, configure the system, and enable features. These cards should always remain with the aircraft. Also, additional blank SD cards need to be available for certain situations such as navigation database updates.

A single .exe file extracted to the SD card contains all G5000 baseline line replaceable unit (LRU) software. The file displays load software to all other LRUs and contains configuration files for each aircraft option that impact the avionics such as:

- Learjet 70 vs. Learjet 75 options
- Federal Aviation Authority (FAA) vs. European Aviation Safety Agency (EASA) requirements
- Oxygen bottle sizes, etc.

Separate data loading cards are used for optional equipment such as upgraded weather radar, a third VHF COM, SurfaceWatch, etc.).

The SD cards in the bottom DU slots are used to hold databases as installed equipment. These cards are as follows:

- Terrain and airport terrain
- Obstacle
- SafeTaxi
- FliteCharts (Garmin)
- ChartView (Jeppesen)
- Airport directory
- Worldwide basemap
- Navigation
- Supporting files such as lock features, airframe information, or cross-filling data

DATABASES

Figure 18

Databases within G5000 systems are used to provide the avionics updates for information that changes more frequently than the software. G5000 systems use multiple databases. The databases are either stored in internal memory of each GDU or accessed from the Secure Digital (SD) card inserted into the GDU.

Following is a list of the databases used by G5000 systems. Always refer to the AMM for database update procedures.

DISTRIBUTOR	DATABASE	UPDATE RATE	TIME LIMIT	STORED LOCATION 1	APPROXIMATE DATA SIZE	DISTRIBUTION METHODS
Garmin	Terrain Database	As needed	No time limit (always operative)	SD card	1 GB	(1) Initial data via SD Card (2) Updates via internet
Garmin	Obstacle Database	56 days	No time limit (always operative)	SD card	4 MB	(1) Initial data via SD Card (2) Updates via internet
Garmin	SafeTaxi Database	56 days	No time limit (always operative)	SD card	8 MB	(1) Initial data via SD Card (2) Updates via internet
Garmin	Airport Directory Database	56 days	No time limit (always operative)	SD card	10 MB	(1) Initial data via SD Card or internet (2) Updates via internet
Garmin	Basemap Database	Periodic (very infrequent)	No time limit (always operative)	Internal (8 MB) SD Card (12 MB)	8 MB (originally programmed at factory) 12 MB	(1) Programmed on internal flash in factory (2) Updates via new SD Card
Jeppesen	Navigation Database	28 days	No time limit (always operative)	Internal	11 MB (Worldwide) 6 MB (Americas) 7 MB (International)	(1) Initial data programmed on internal flash (2) Updates via internet (3) Card Exchange
Jeppesen	ChartView Database	14 days	Inoperative 70 days after expiration	SD card	450 MB (Worldwide) 150 MB (Americas)	(1) CD (2) Updates via internet

NOTE
1 All database cards should be installed in the bottom SD card slot of each display unit (DU).

LJ75_3140_0004

Fig. 18: Secure Digital Cards

Basemap

The basemap provides ground based references such as roads and bodies of water. The data is stored on the SD card. The basemap does not have a scheduled update cycle and as such does not have an expiration date.

Terrain and Airport Terrain

The terrain and airport terrain databases are required to be present for functions such as Synthetic Vision System (SVS), TAWS, and TERRAIN-SVS. The standard terrain database provides ground elevation with a 30 arc-sec resolution. The airport terrain provides additional resolution near most airports with a resolution of 9 arc-sec. A higher resolution terrain database is utilized with SVS that provides continuous 9 arc-sec resolution.

Obstacle

The obstacle database provides identification of known obstacles greater then 200 ft AGL. This database is also used with TAWS and TERRAIN-SVS. Obstacle data is available for the United States and for Europe.

SafeTaxi

SafeTaxi diagrams provide detailed taxiway, runway, and ramp information at more than 900 airports in the United States.

Jeppesen ChartView

ChartView resembles the paper version of Jeppesen terminal procedures charts. The charts are displayed in full color with high-resolution. The MFD depiction shows the aircraft position on the moving map in the plan view of approach charts and on airport diagrams. The ChartView database subscription is available from Jeppesen. Available data includes:

- Arrivals (STAR)
- Departure Procedures (DP)
- Approaches
- Airport Diagrams
- NOTAMs
- Charts are geo-referenced (Airplane spotter displayed over chart where appropriate)

ChartView key points:

- Activation by OEM or Service Center
- Updated by the end user via the Jeppesen database update process
- Activation requires the use of an enable card to be inserted into PFD1 with all displays powered. Once activated, the unlock card becomes linked to the particular aircraft

Jeppesen Navigation Database

The Jeppesen Navigation Database contains the aeronautical data used by the GIFD system for the flight management and flight planning functions. Included is detailed data

for waypoints, procedures (arrivals, departures, approaches), and airways. This Jeppesen database is updated every 28 days.

Aviation Database key points:

- Updated by the end user via the Jeppesen database update process
- Navigation database is downloaded to a single card (per the Jeppesen database update process) and then loaded to the internal memory of each GDU

Airport Directory Database

The Airport Directory Database resembles the paper version of the AOPA Airport Directory. The data is accessed through the airport waypoint pages and includes detailed supplementary information for airports in the United States. Available data includes information on:

- Traffic Pattern altitudes
- Runways (dimensions, surface, and lighting)
- On airport Fixed Base Operators (fuel types, aircraft maintenance services, rental car, and other services available)
- FSS and Weather contacts
- Navaids serving the airport
- Nearby lodging and restaurants

Airport Directory Database key points:

- This data is stored on the database SD cards
- The feature is not configurable and can not be enabled/disabled by the flight crew
- The SD cards in the MFD are searched for the Airport Directory database at power-up. The feature is disabled if the Airport Directory database is not present.

Additional SD Card Files

While not actually databases, the following files can be added to the same SD card that stores the databases.

Electronic Checklists

Installation and updates of this file are controlled by the OEM.

OEM Diagnostics

Installation and updates of this file are controlled by the OEM.

Database Expiration Information

Figure 20 and Figure 19

Database status can be seen on DU2 after power up. The same information can also be viewed on the GTCs at any time.

The G5000 system has an Automatic Database Synchronization Feature that will automatically transfer databases from a single SD card to the SD cards on PFD and MFD to ensure that all databases are synchronized. After power up the system compares all copies of each applicable database. If similar databases do not match, the most recent valid database is copied to each card in the system.

The following databases are checked and synchronized:

- Basemap
- SafeTaxi
- Airport Terrain
- Obstacle
- Airport Directory (AOPA)
- Terrain

Fig. 19: Database Status on GTC 1 or GTC 2

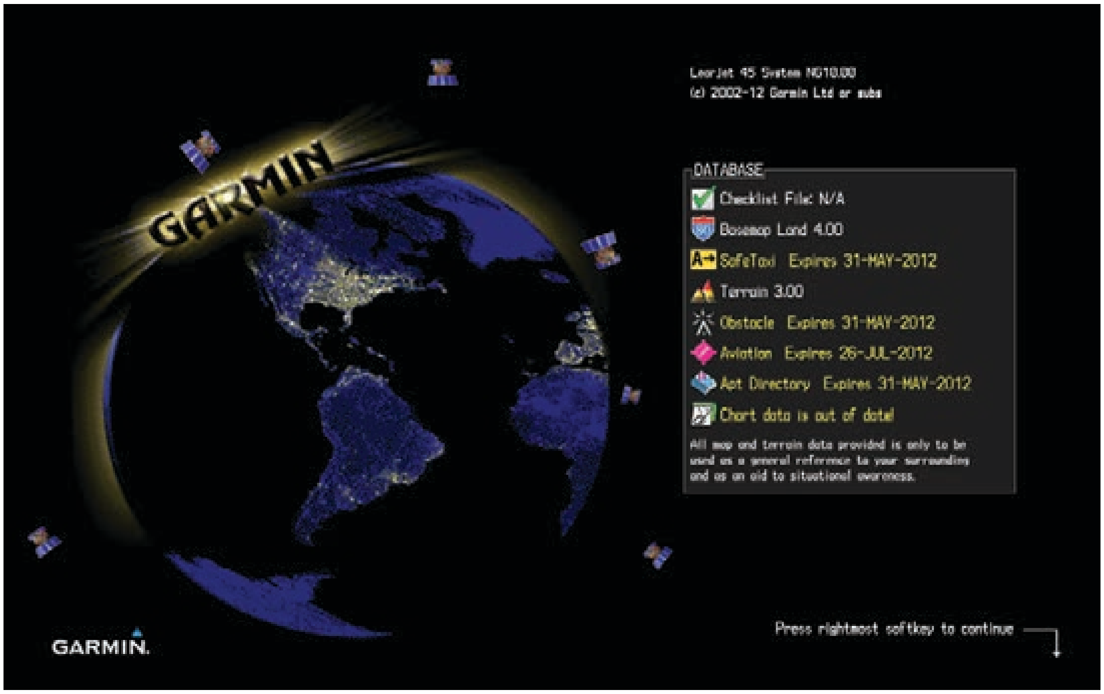


Fig. 20: Database Status on DU 2

FAULT INDICATION

Table 2: SD Cards – CAS Messages

CAS MESSAGE	LOGIC AND ASSOCIATED BUSES
DU 1 CARD BOT	PFD1 lower card has been removed when GDU was powered
DU 2 CARD BOT	MFD lower card has been removed when GDU was powered
DU 3 CARD BOT	PFD 2 lower card has been removed when GDU was powered
DU 1 CARD TOP	PFD1 upper card has been removed when GDU was powered
DU 2 CARD TOP	MFD upper card has been removed when GDU was powered
DU 3 CARD TOP	PFD2 upper card has been removed when GDU was powered

Table 2: SD Cards – CAS Messages

CAS MESSAGE	LOGIC AND ASSOCIATED BUSES	
AVIONICS CONFIG	At least one of the software/configuration/manifest system messages has been triggered At least one software/configuration/manifest system message has triggered:	
	DB MISMATCH (nav db)	GEA2 MANIFEST
	DB MISMATCH (stby nav db)	GEA4 MANIFEST
	MANIFEST	GSD2 MANIFEST
	AUDIO MANIFEST	GMA1 CONFIG
	GFC MANIFEST	GMA1 MANIFEST
	PFD1 DB ERR	DIG GMA1 MANIFEST
	PFD1 CONFIG	GMA2 CONFIG
	PFD1 SOFTWARE	GMA2 MANIFEST
	PFD1 MANIFEST	DIG GMA2 MANIFEST
	PFD2 DB ERR	GCU1 CONFIG
	MFD1 CONFIG	GCU1 MANIFEST
	MFD1 DB ERR	GCU2 CONFIG
	MFD1 SOFTWARE	GCU2 MANIFEST
	MFD1 MANIFEST	GMC CONFIG
	PFD2 DB ERR	GMC MANIFEST
	PFD2 SOFTWARE	XPDR1 CONFIG
	PFD2 MANIFEST	GTX1 MANIFEST
	GTC1 MANIFEST	XPDR2 CONFIG
	GTC1 CONFIG	GTX2 MANIFEST
	GTC1 DB ERR	GTS CONFIG
	GTC2 MANIFEST	GTS MANIFEST
	GTC2 CONFIG	GDL69 CONFIG
	GTC2 DB ERR	GDL69 MANIFEST
	GIA1 CONFIG	GDC1 MANIFEST
	GIA1 MANIFEST	GDC2 MANIFEST
	GIA2 CONFIG	GRS1 MANIFEST
	GIA2 MANIFEST	GRS2 MANIFEST
	GSD1 CONFIG	GWX CONFIG
	GEA1 CONFIG	GWX MANIFEST
	GEA3 CONFIG	GDL59 CONFIG
	GEA1 MANIFEST	GDL59 MANIFEST
	GEA3 MANIFEST	AHRS MAG DB SIMULATOR
	GSD1 MANIFEST	GDR/COM 3 CONFIG
	GSD2 CONFIG	GDR/COM 3 MANIFEST
	GEA2 CONFIG	GDR/COM 3 AUX MANIFEST
	GEA4 CONFIG	

CENTRAL COMPUTING SYSTEM

(ATA 31-41-00)

OVERVIEW

Processing for the G5000 Avionics System takes place in the integrated avionics units and display units. They use an Ethernet-based high-speed data bus (HSDB), to supply the primary interface between individual LRUs of the G5000 avionics suite. Each connection between those sub-systems is a point-to-point, full-duplex connection that uses standard Ethernet technology and Garmin proprietary protocols.

Each GIA is paired with the onside PFD via a HSDB connection. The GIA units communicate directly with each other via the CAN protocol only if a system data path failure occurs.

COMPONENTS

The central computing system consists of:

- Integrated avionics units (GIAs) (2)

Associated Components

- Display units (GDUs) (3)

COMPONENT DESCRIPTIONS

Integrated Avionics Unit (GIA)

Two GIAs function as the main communication hub to the G5000 system linking all LRUs with the PFD and MFD displays. Each unit contains a GPS/WAAS receiver, VHF Com/Nav receiver, flight director, aircraft I/O interfaces, and system integration microprocessors.

The GIAs communicate directly with the display units using a HSDB Ethernet connection. Software and configuration settings are sent from the displays through the GIAs to LRUs in the system. Both GIAs are located forward of the instrument panel.

SYSTEM OPERATION

Figures 21, 22, and 23

Each integrated avionics unit performs main processing functions that are computed by components on two separate, printed circuit boards (PCBs) known as Main 1 and Main 2, the latter of which contains the main power supply for the integrated avionics units.

These main processing components within the integrated avionics units are called the “GIA Main” subsystem and are referred to as integrated avionics unit 1 (left GIA) and integrated avionics unit 2 (right GIA) in the G5000 avionics system.

The integrated avionics unit main subsystem handles inputs to and outputs from the integrated avionics unit in addition to performing various computations within the integrated avionics unit.

Each Display unit contains a Central Processor Unit and 3D graphics processor.

On power up each unit performs a self test. During normal operation each display unit is continuously monitoring its operation including symbol generator, synthetic vision operation, and database integrity.

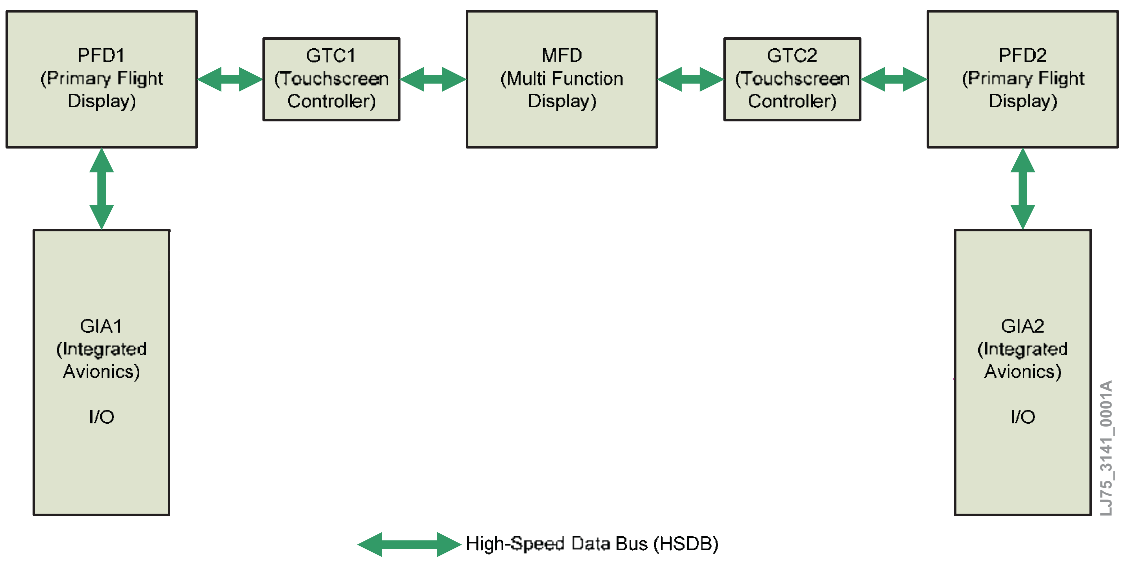


Fig. 21: G5000 Central Computing System Block Diagram

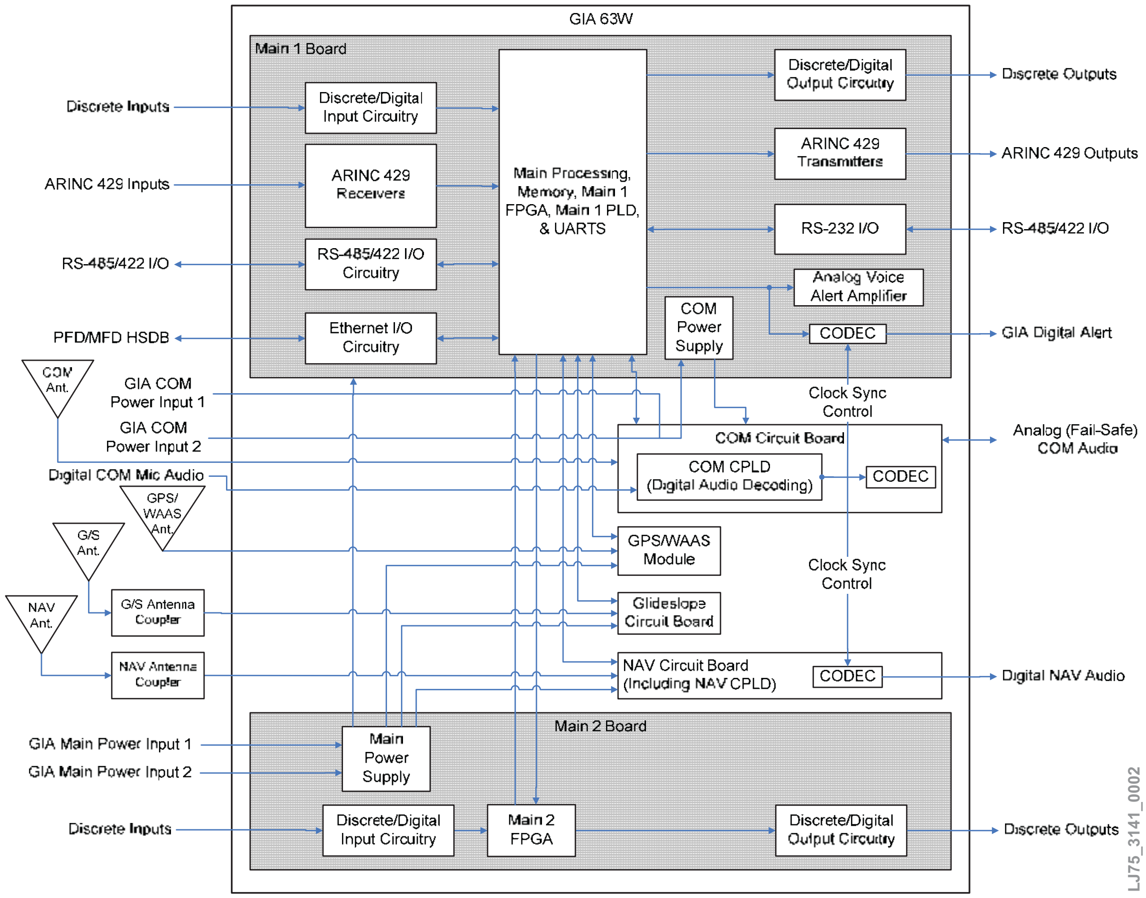


Fig. 22: Integrated Avionics Unit Block Diagram

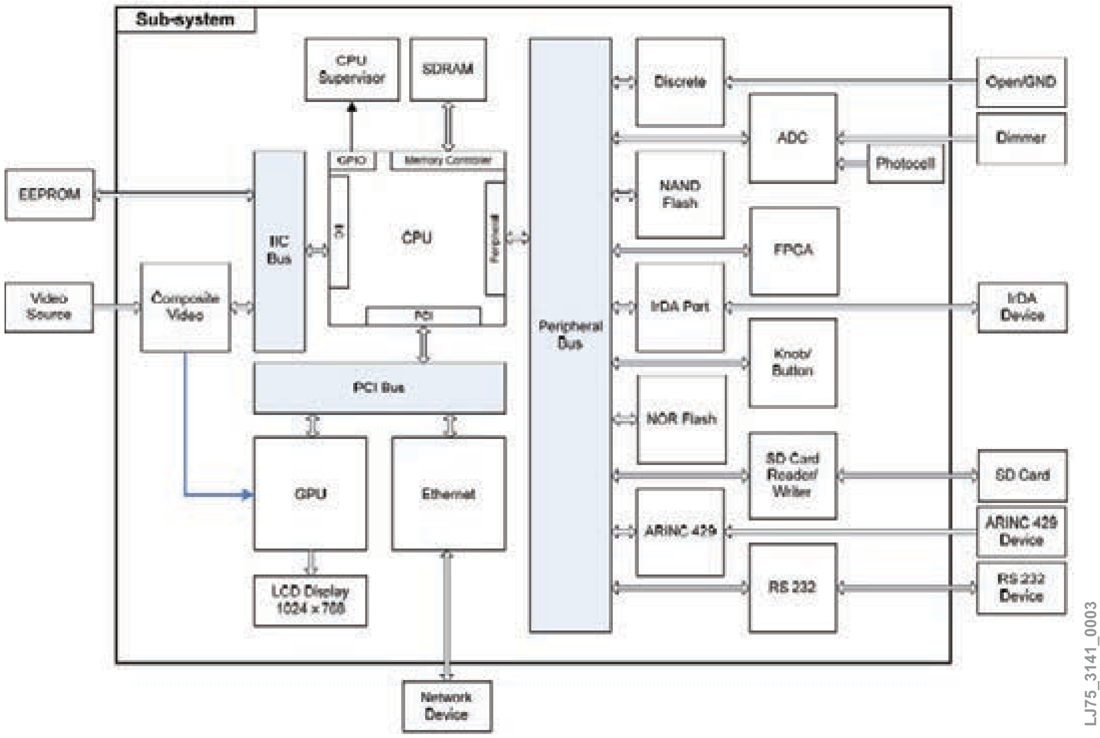


Fig. 23: GDU 1400W Subsystem Architecture

FAULT INDICATION

Table 3: Central Computing System – CAS Messages

CAS MESSAGE	LOGIC
GIA 1 FAIL	GIA 1 has failed
GIA 2 FAIL	GIA 2 has failed
GPS DATE MSCMP	The dates in the GIAs differ by more than 2 days
GIA 1 FAULT	GIA 1 temperature is too low or needs service or GIA 1 overtemperature
GIA 2 FAULT	GIA 2 temperature is too low or needs service or GIA 2 overtemperature

ENGINE INDICATING AND CREW ALERTING SYSTEM

(ATA 31-51-00)

OVERVIEW

The engine indicating and crew alerting system (EICAS) is the primary display for the engine instrumentation and some individual system parameters in relation to flight phase. The EICAS also includes the crew alerting system (CAS) which notifies the flight or maintenance crew aurally and visually of aircraft changes which require action or attention.

A warning alert needs immediate pilot action, a caution alert needs subsequent intervention, and an advisory indication needs pilot or maintenance action at some point in time.

COMPONENTS

Figures 24 and 25

- Engine and airframe interface units (GEAs) (4)
- Serial data concentrators (GSDs) (2)
- WARN/CAUT switch/annunciators (2)

Associated Components

- Audio processor units (GMAs) (2)
- Integrated avionics units (GIAs) (2)
- Display units (GDUs) (3)
- Engine signal conditioners (GSCs) (2)
- Touch controllers (GTCs) (2)
- DU Reversion/Dimming Panel
- Remote controllers (GCUs) (2)

COMPONENT DESCRIPTIONS

Engine and Airframe Interface Units

Figure 25

The four engine and airframe interface units measure analog, digital, and discrete sensor inputs and drive annunciator outputs for the airframe and engine systems. The interface units supply inputs to the DUs via the two integrated avionics units.

The interface units are micro-processor based input/output line replaceable units (LRUs) that inform the two integrated avionics units which high-speed data bus (HSDB) packet to populate for display on the DUs.

The four interface units are installed behind the DUs. Unit 1 is installed behind DU 1; unit 2 is installed behind DU 3; units 3 and 4 are installed behind DU 2.

Serial Data Concentrator Units

Figure 25

The serial data concentrator units 1 and 2 include Ethernet interfaces which operate the common HSDB protocol. Data on the HSDB network has a source and destination. For example, the serial data concentrator unit is the source for the digital electronic engine control (DEEC), and the DU is the destination for the engine parameters display. Data is dynamically routed through the systems from source to destination via the serial data concentrator units (DCUs).

The two serial DCUs are installed behind DU 2. Serial DCU 1 is installed adjacent to the engine and airframe interface unit 3. The serial DCU 2 is installed adjacent to the engine and airframe interface unit 4.

WARN/CAUT Switch/Annunciators

Figure 26

The two WARN/CAUT switch/annunciators, installed on the glareshield in front of each crewmember, alert of any unsafe system operating conditions. This alerts the crew to take the appropriate corrective action and keep additional hazards to a minimum.

Red WARN annunciators are activated by the CAS warning messages and initially flash when triggered. When the master warning is acknowledged by pushing either WARN/CAUT switch/annunciator, both WARN annunciators silence and the related CAS message stops flashing and remains illuminated.

Amber CAUT annunciators are activated by the CAS caution messages and initially flash when triggered. When the master caution is acknowledged by pushing either WARN/CAUT switch/annunciator, both CAUT annunciators silence and the related CAS message stops flashing and remains illuminated.

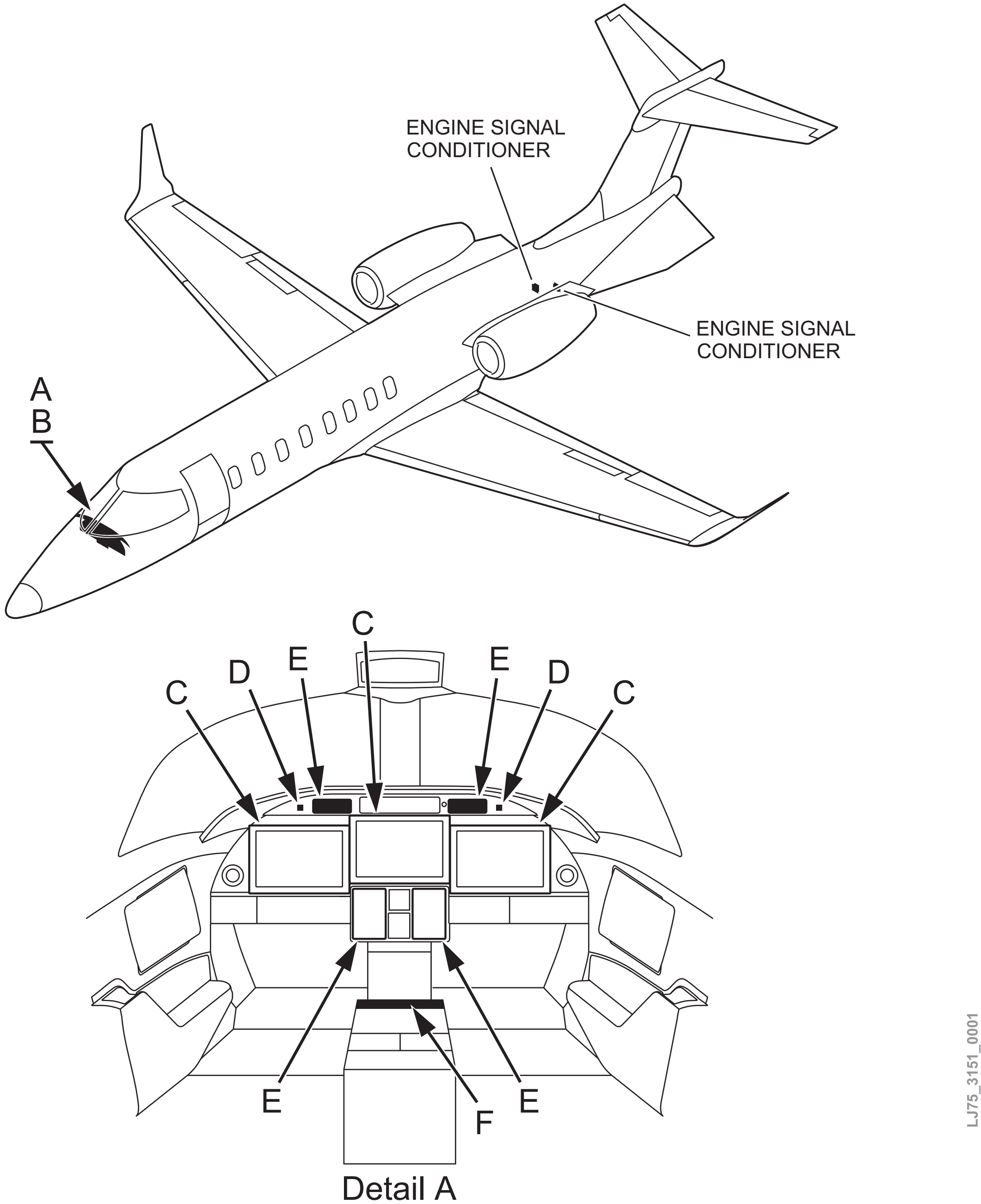
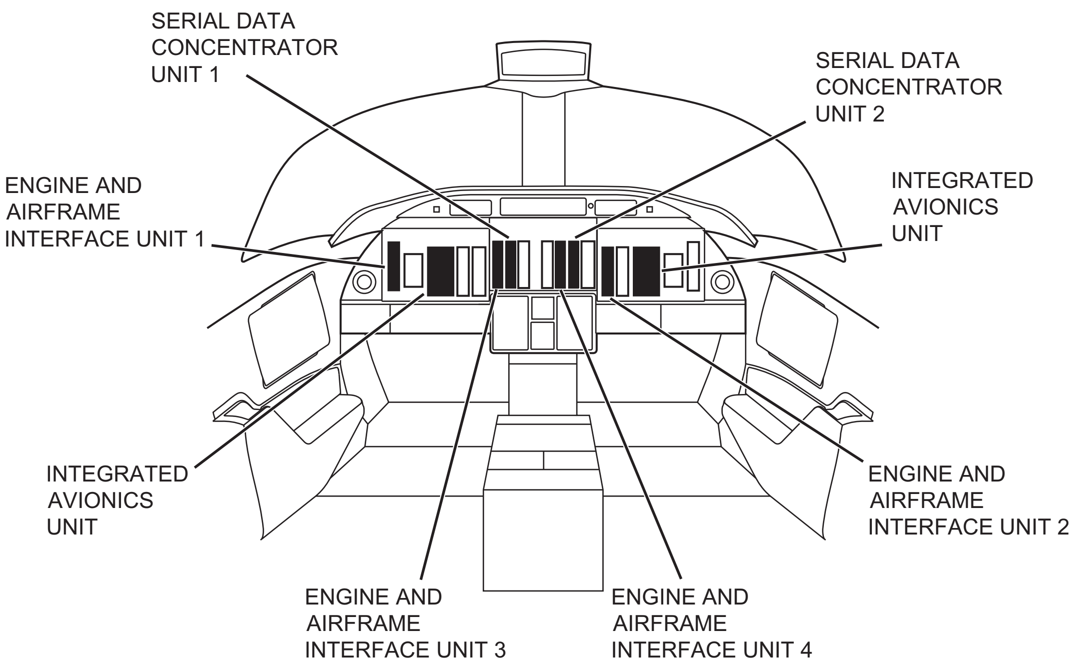
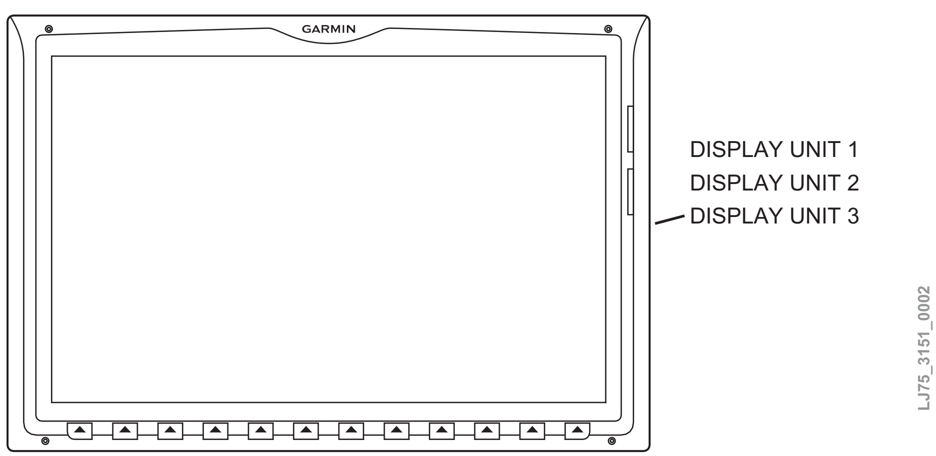


Fig. 24: Flight Deck Component Locator (1 of 3)



Detail B



Detail C

Fig. 25: Flight Deck Component Locator (2 of 3)

Integrated Avionics Units

Figure 25

Two integrated avionics units are micro-processor based input/output LRUs which communicate with the DUs via the HSDB.

From an EICAS perspective, the GIAs perform the following functions:

- Input/output processing
  - The GIAs communicate with GDC Air Data Computer units, DME Distance Measuring Equipment, GMU Magnetometer units, GSA units for yaw, pitch and roll information, GTA units for horizontal stabilizer information and GEA units for engine and airframe data
  - This information is received in formats compatible with multiple data bus types (RS-232, RS-485 and ARINC-429). Much of this information is then forwarded to GDU 1 and GDU 3 using the HSDB data busses.
- Forwarding of data from other data acquisition units
  - Data collected from GEA1 and GEA2 on RS-485 busses is forwarded to display units DU1 and DU3 on the HSDB data busses
- Aural alert processing is handled by the GIA units
  - The aural alerting system separates aural alerts into two categories: Class 1 aural alerts have higher priority than Class 2 aural alerts and take precedence over Class 2 aural alerts
  - Aural alerts within those priority classes are prioritized relative to each other
  - Higher priority alerts within a class are presented before lower priority alerts
  - Priority assignments are consistent with AC 20-151A. Messages are queued such that no Class 2 messages are presented until all Class 1 messages are removed from the queue
  - Aural messages may or may not be associated with CAS messages
  - They may or may not be mutable and they may or may not, by design, repeat
  - These features of the aural message repertoire are generally message severity dependent and are defined in technical requirements document TRD-176-009 (M176 CAS Requirements)
- Fire Alerting/Squib monitoring functions previously performed by the Crew Warning Panel:
  - The GIA triggers the lights, inputs are from the GEAs and processing for this function is done in the CAS master

Display Units (DU1, DU2, and DU3)

Figure 25

The display units contain the processing logic for EICAS. One display unit is the CAS Master. Under normal circumstances, GDU 1 is the CAS master. However, if GDU 1 fails, GDU 3 immediately and seamlessly transitions to the role of CAS Master. If GDU 3 fails, then GDU 2 assumes the role of CAS Master. The CAS Master display determines if an advisory, caution, or warning condition exists, based on the inputs received by the G5000 from the airplane systems conditioned by the CAS logic contained in the display

software and configuration data. The CAS Master display unit continually tells the remaining displays its current CAS status. The remaining displays operate in sync with that CAS status irrespective of their own CAS processing. Each non–Master display unit consistently maintains its own constant CAS logic in case it is required to assume the role of CAS Master.

The three DUs are identical and consist of a 14-inch (35.6-cm) diagonal display unit. The EICAS primary display location is on DU 2. It also shows in the same configuration on the left side of the DU 1 and DU 3 in any reverted format. If a DU failure occurs, the EICAS shows as a 60/40 reversionary display.

Other aircraft system parameters also show on the DUs. The display controls consist of:

- Two touch controllers, GTC 1 and GTC 2
- DU reversion/dimming control panel
- Pilot and copilot remote controllers

Refer to the electronic flight instrument system (EFIS) section (31-61-00) for more details on the DUs control and operation.

The three DUs are installed side by side in the instrument panel. The two touch controllers (GTC 1 and GTC 2) are installed below the DU 2 on the tilt panel. The DU reversion/dimming panel is installed in the center pedestal. The pilot and copilot remote controllers are installed on the glareshield facia panel above the DU 1 and DU 3, respectively.

Engine Signal Conditioners

Figures 25

The two engine signal conditioners convert the N1 and N2 sinusoidal outputs from their respective engine monopole-signal generators to digital signals used by the four engine and airframe interface units.

One engine signal conditioner is used for each engine. Engine signal conditioner 1 (used for left engine) supplies outputs to interface units 1 and 3. Engine signal conditioner 2 (used for right engine) supplies outputs to interface units 2 and 4.

The two engine signal conditioners are installed in the aft fuselage at FS 597 RH. Engine signal conditioner 1 is installed below the right aft power distribution panel (ADP); engine signal conditioner 2 is installed in front of the right main battery.

Audio Processors

The audio processor unit processes audio signals as well as interfaces to all audio signal sources and destinations. Each unit integrates NAV/COM digital audio, intercom system, and marker beacon functions. Each unit communicates with its onside GTC via the HSDB and its cross-side integrated avionics unit via the RS-232 as a backup control path. The audio processor 1 provides an interface to the pilot headset, and the audio processor 2 provides the interface to the copilot headset. The two audio processors unit 36 share audio signals as necessary on a direct connection via a digital audio bus. The audio processor unit 36 utilizes digital audio technology, which allows mixing of audio from various sources. The audio processor unit interfaces include COM radios, NAV radios, as well as prioritized and mixed aural alerting.

CONTROLS AND INDICATIONS

Figures 26 and 30

The display controls consist of two touch controllers GTC 1 and GTC 2, a DU reversion/dimming control panel, and the pilot and copilot remote controllers. They access the EICAS related system pages in normal and reversionary modes.

Normal Mode—The normal EICAS display shows as a strip on the left side of DU 2 as shown.

Reversionary Mode—EICAS information is available in a 60/40 presentation during reversionary mode and contains the same information as the normal display EICAS strip as shown.

The CAS knob is used to scroll through multiple pages of CAS messages. DU dimming is accomplished via the DU reversion/dimming control panel. The EICAS display format can be set on DU 2 or DU 3 via the DU reversion/dimming control panel.

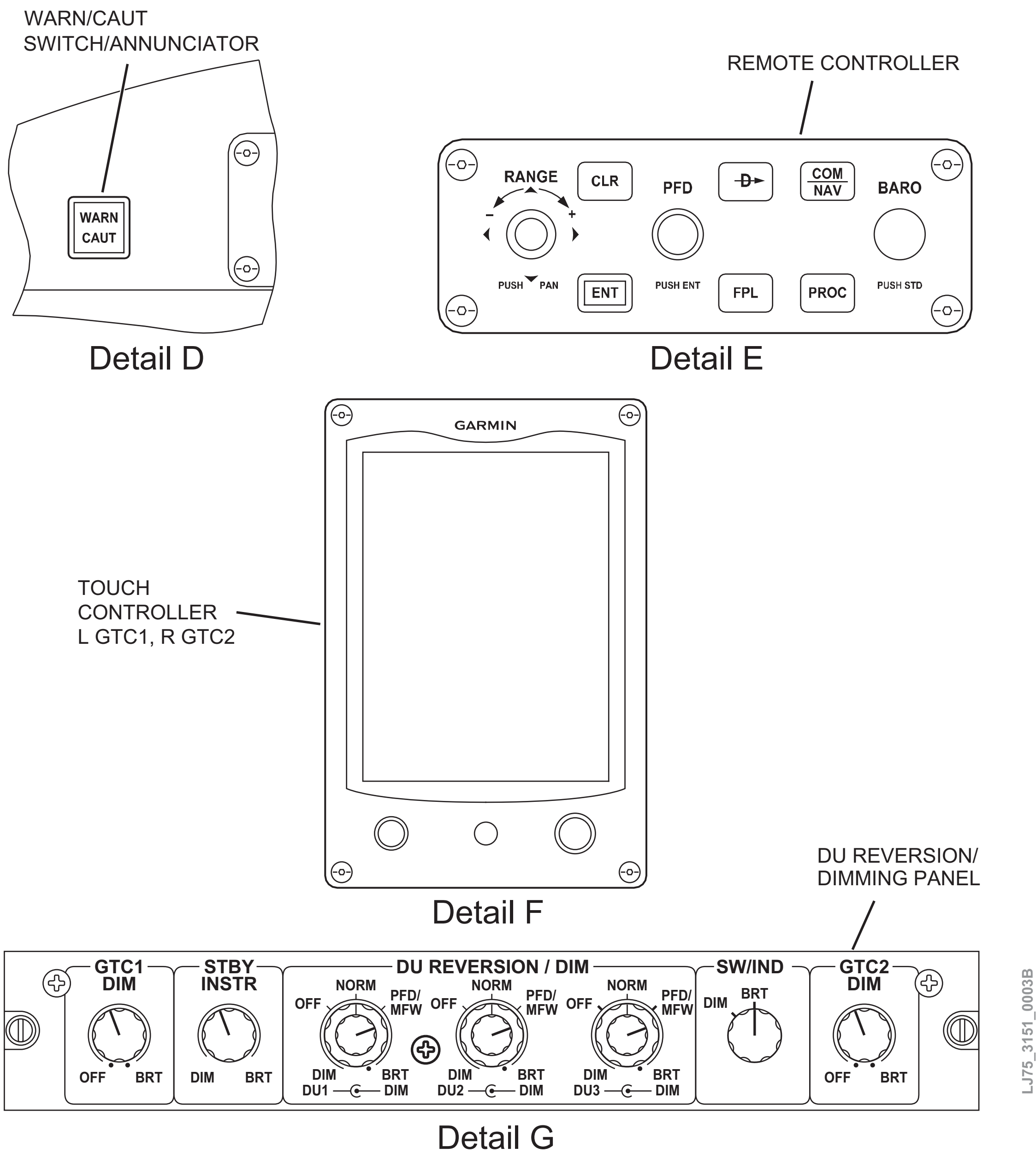


Fig. 26: Flight Deck Component Locator (3 of 3)

SYSTEM OPERATION

Figures 27, 28, 29, and 30

Data from airframe and engine sensors are gathered by four engine and airframe I/O units (GEAs), two data concentrator units (GDCs), and two integrated avionics computers (GIAs). Data from GEA 1 and GEA 2 is sent to GIA 1 and GIA 2 via RS-485. Data from GEA 3 and GEA 4 is sent to GSD 1 and GSD 2 via RS-485. Data is sent from the GIAs and GSDs to the GDUs via Garmin high-speed databus (HSDB). Each engine's N1 and N2 signals are first converted to a constant-amplitude variable-frequency digital signal by an onside GSC signal conditioner prior to being routed to the onside GEAs.

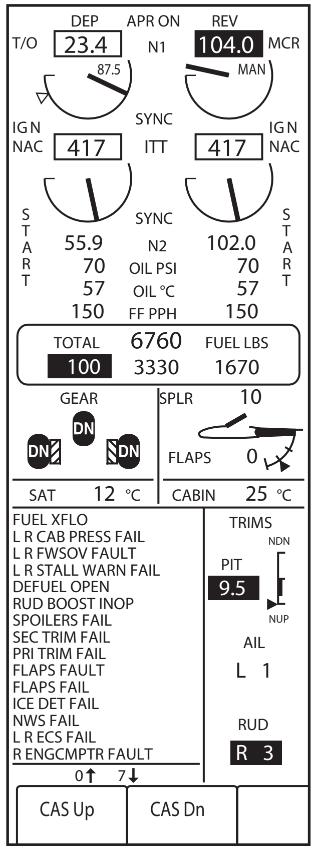
EICAS Display

The engine instruments (E/I) page is the primary EICAS display format and shows at all times. This page includes the parameters that follow:

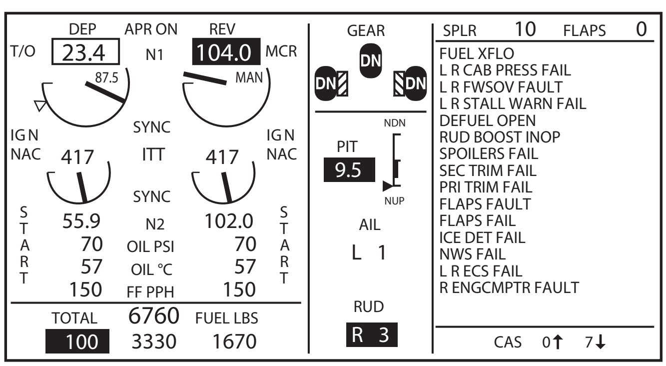
- N1
- N2
- ITT
- Oil pressure
- Oil temperature
- Fuel flow
- Fuel quantity
- Landing gear position (blank when gears are up and flaps at 0°)
- Spoilers position
- Flaps position
- Static air temperature (SAT)
- Cabin temperature
- Trims (pitch, aileron, and rudder)
- CAS messages

If a display failure occurs, the EICAS window may be recovered by reverting one or both of the operating DUs to the primary flight display/multifunction window (PFD/MFW) mode. The primary location is on the center DU 2 display. The EICAS strip is then changed to a 60/40 presentation and shows the same information. Refer to Figure 27 for the reversion mode configuration displays.

The synoptic pages are available on any DU via the MFW. The synoptic pages show the current status of the aircraft systems, including the summary, electrical, hydraulic, environment control, flight controls and doors, and fuel system pages. Refer to Figure 28 and 29 for synoptic page displays. Refer to related system descriptions for the display details.

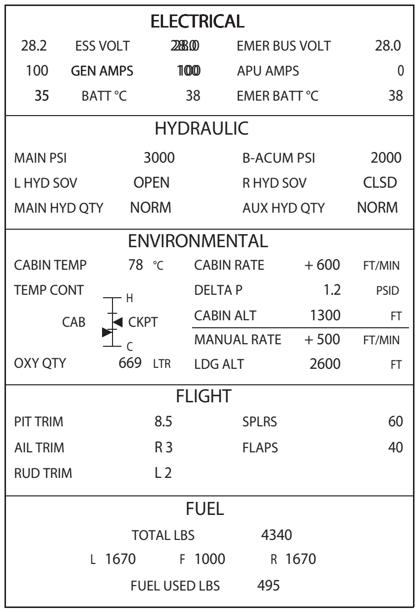


NORMAL MODE − STRIP

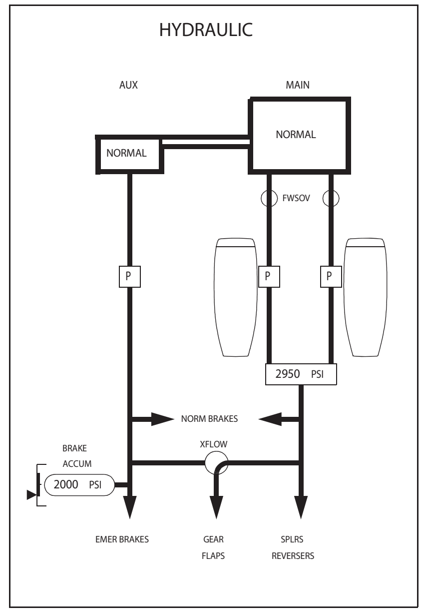


REVERSIONARY MODE
60/40 PRESENTATION

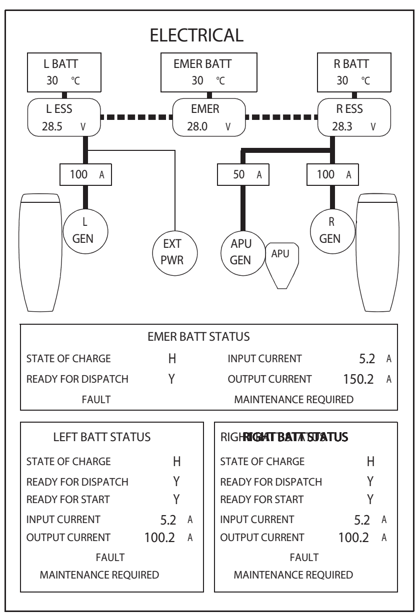
Fig. 27: Normal and Reversionary Modes



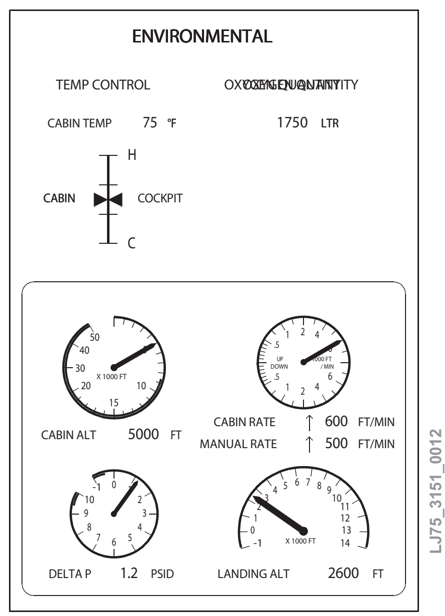
SUMMARY SYNOPTIC PAGE



HYDRAULIC SYSTEM SYNOPTIC PAGE

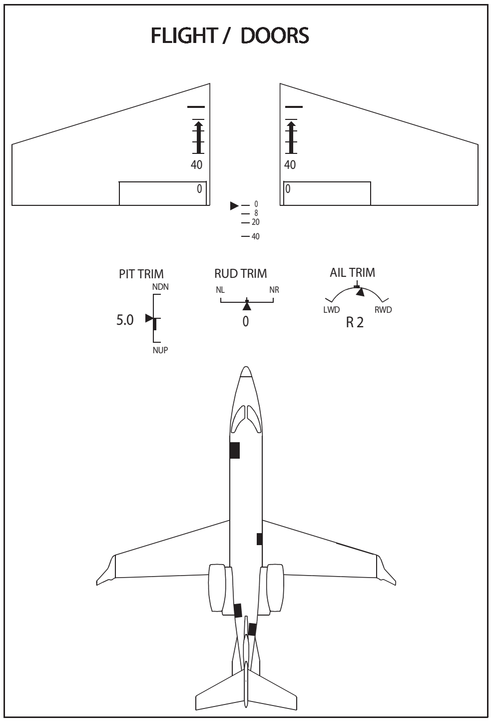


ELECTRICAL SYSTEM SYNOPTIC PAGE (NORMAL DISPLAY)

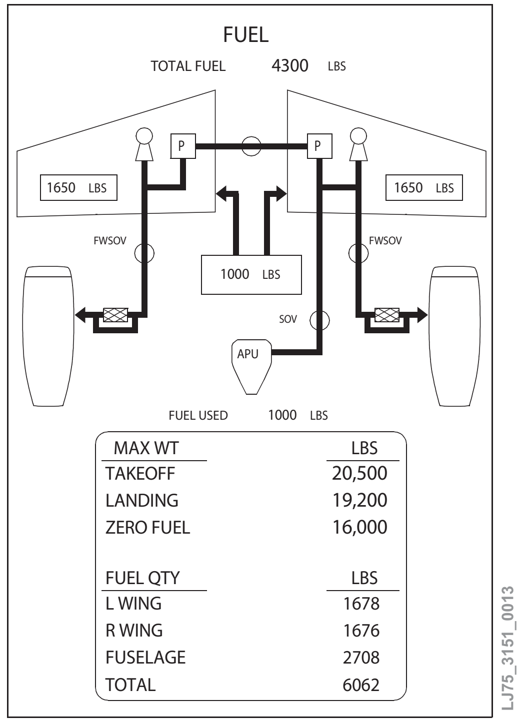


ENVIRONMENTAL CONTROL SYSTEM (ESC) SYNOPTIC PAGE

Fig. 28: Aircraft Synoptic Pages



FLIGHT CONTROLS SYSTEM AND DOORS SYNOPTIC PAGE



FUEL SYSTEM SYNOPTIC PAGE

Fig. 29: Aircraft Synoptic Pages (Continued)

CREW ALERTING SYSTEM

Crew alerting is done by visual and aural indications. Aural alerts are generated by the two integrated avionics units and processed by the two audio processor units. The command to process an aural alert is sent from the DU used as the alert master controller to both integrated avionics units. Engine parameters and trim positions show as inverse video during an alert. CAS message shows in normal video on a black background when posted steady.

The aural alerts are usually processed only by the integrated avionics unit 1 unless the unit fails. If the integrated avionics unit no.2 cannot detect that the no. 1 is available, then the no. 2 will process the aural alerts. When multiple aural alert conditions are present, the alerts are queued, then processed in order of priority. Each audio processor unit can be configured to receive alert audio directly from both integrated avionics units (via analog connections). The audio processor units can be configured to process alerts independent of the pilot-selected state of each unit, so that aural alerts are always heard. The two audio processor units can each be configured to pass aural alerts to the on-side pilot or copilot headset in the event of an audio processor unit failure via a failsafe analog path.

Aural alerts are computer-generated male or female voices and are pilot-selectable (male voice is the default).

Red is used for warning displays that need immediate pilot attention. When a warning message occurs, red message flashes until acknowledged by pushing either WARN/CAUT switch/annunciator and then becomes steady. The CAS warning message goes off when the fault is corrected.

Amber is used for caution displays that need subsequent pilot attention. When a caution message occurs, amber message flashes until acknowledged by pushing either WARN/CAUT switch/annunciator and then becomes steady. The CAS caution message goes off when the fault is corrected.

White is used for advisory or status information that needs pilot or maintenance action at some point in time. When they occur, the white CAS message flashes for 5 seconds and then stays on steady.

Visual Alerts

Visual indications are supplied by the CAS messages and the related master WARN and CAUT annunciators.

Master WARN annunciators—The red WARN annunciators use a split legend switch/ annunciator with the master CAUT annunciators. The annunciators supplement the red warning messages shown on the CAS window. The master WARN annunciators flash when a warning condition occurs. The crew acknowledges the warning by pushing either master WARN/CAUT switch/annunciator, causing the two WARN annunciators to silence while the message/annunciator stops flashing and remains illuminated.

The master WARN/CAUT switch/annunciators go to their normal state and the WARN annunciators come on again if another warning occurs. The initial warning annunciator, which is set on with the master WARN/CAUT switch/annunciators, stay on as long as there is an abnormal condition. The warning alert system automatically resets if

the abnormal condition self-corrects or is corrected.

Master CAUT annunciators—The amber CAUT annunciators use a split legend switch/annunciator with the master WARN annunciators. The annunciators supplement the amber caution messages shown on the CAS window. Two master CAUT annunciators flash when a caution is sensed, and the relevant amber message also flashes on the CAS window. Pushing either master WARN/CAUT switch/annunciator resets the caution message. The related CAS caution message stops flashing and the two CAUT annunciators silence while the message/annunciator remains illuminated steadily.

The CAUT switch/annunciators go to their normal state and come on again if another caution is sensed. The initial caution annunciator, which is set on with the master WARN/CAUT switch/annunciators, stay on as long as there is an abnormal condition. The caution alert system automatically resets if the abnormal condition self-corrects or is corrected.

Aural Alerts

Aural alerts are generated and prioritized by each integrated avionics unit and then processed by the two audio processor units. The main alert logic is processed in the DUs and aural alert commands are sent to each integrated avionics unit. External to the DUs, some aural alerts may also sound, such as the AP disconnect tone which is generated by the integrated avionics unit.

Once the aural alert commands are received by the integrated avionics unit, it performs the following functions:

- Keeps a prioritized queue of aural alerts to be processed
- Generates a digital aural alert (tone/voice alert) from the audio database stored in the integrated avionics units
- Sends digital/analog audio signals to the audio processor units; aural warnings are heard through the crew headphones and cockpit speakers
- Sends a discrete output signal to indicate when selected alerts are active; this inhibits third-party audio sources when high-priority generated alerts (from the integrated avionics units) are active
- Reads an input discrete to inhibit the generated alerts from the integrated avionics units if a higher priority third-party audio source is also active

NOTE

Aural alerts are heard per highest priority criteria. Once started, each alert is heard through completion. The highest priority message not yet heard starts next.

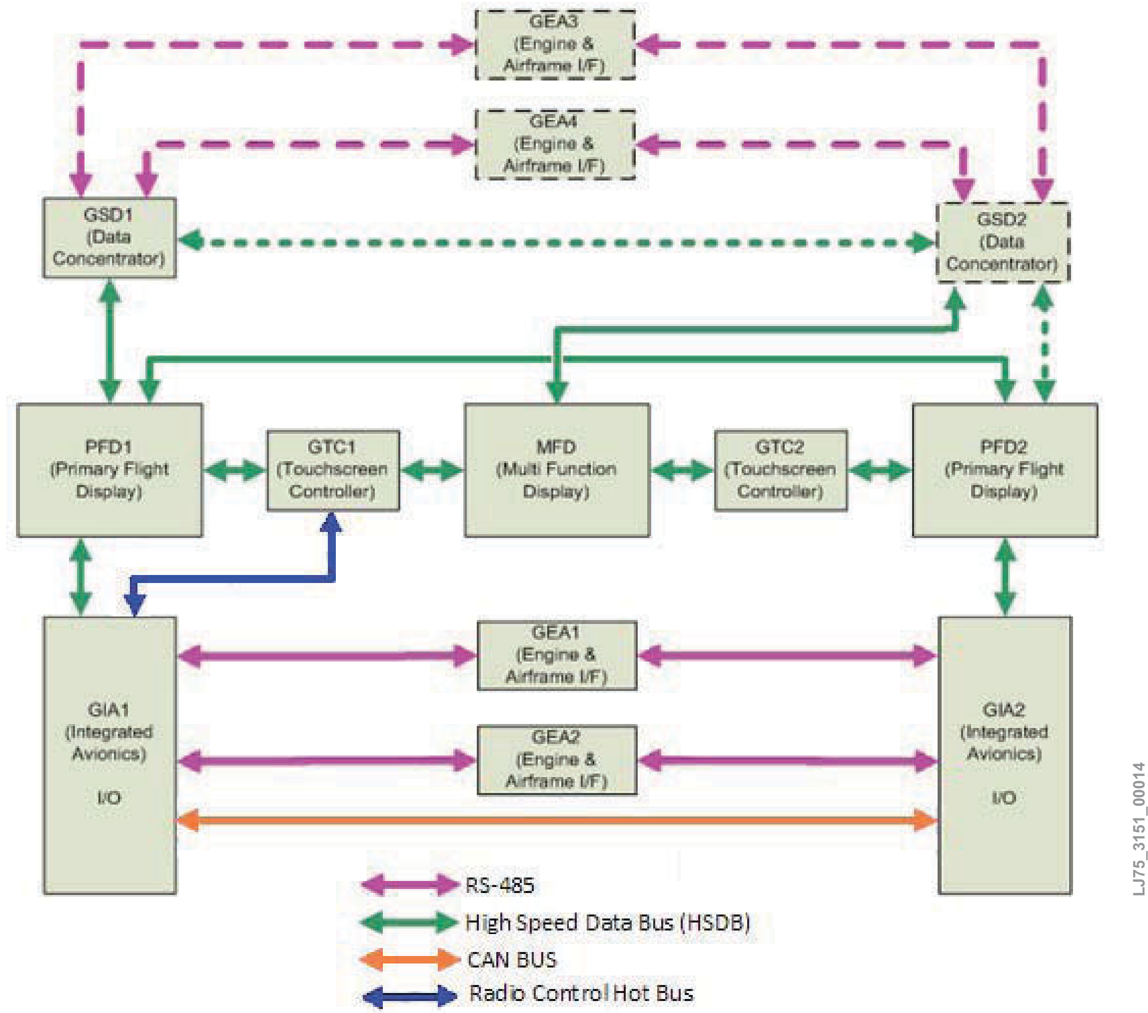


Fig. 30: Engine Indication System (EIS) Block Diagram

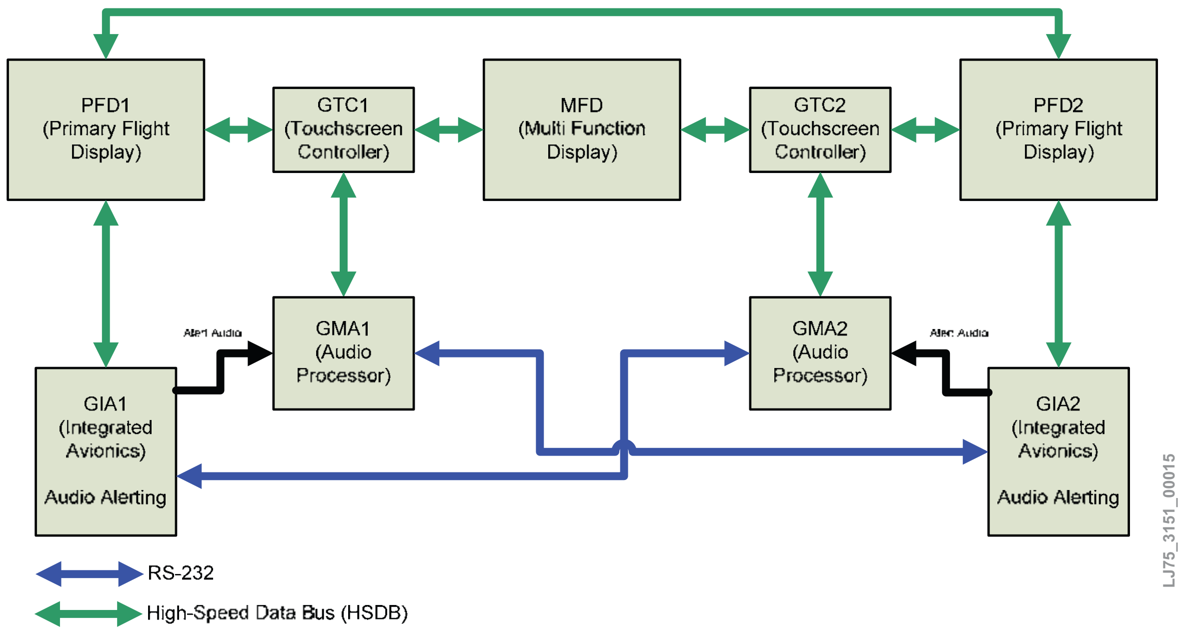


Fig. 31: CAS Block Diagram

CAS Message Inhibit Modes

Engine Starting

The following caution CAS messages are inhibited during engine starting

- LR ESS BUS VOLTS
- LR GEN AMPS HIGH (2 min)
- APU AMPS HIGH (2 min)
- EMER BUS VOLTS
- EMER BATT LOW (2.5 min)
- GEAR

Takeoff Inhibit

The Takeoff Inhibit is set active when all of the following conditions are met:

- L Throttle >82% Thrust (discrete active)
- R Throttle >82% Thrust (discrete active)
- L WOW Generic is true (on ground) (discrete active)
- R WOW Generic is true (on ground) (discrete active)
- L displayed airspeed is > 40 knots (Onside selected filtered air data source)
- R displayed airspeed is > 40 knots (Onside selected filtered air data source)

The Takeoff Inhibit is cleared when any one (or more) of the following conditions occurs:

- 30 seconds after the L WOW Generic becomes inactive (in air)
- 30 seconds after the R WOW Generic becomes inactive (in air)
- (L Throttle is idle or R Throttle is idle) & (L WOW Generic is active or R WOW Generic is active) & (L ADC IAS ≤ 40 knots or R ADC IAS ≤ 40 knots)
- Aircraft is >400 ft. AGL (RAD ALT)
- Takeoff Inhibit has been active for 60 seconds
- Left and right displayed airspeed goes invalid.
- Radio Altimeter data goes invalid

Landing Inhibit

The Landing Inhibit is set active when all of the following conditions are met:

- L Gear Not Up (discrete not active)
- R Gear Not Up (discrete not active)
- L Throttle Not >82% (L Throttle >82% not active)
- R Throttle Not >82% (R Throttle >82% not active)
- L WOW Generic Not Active (in air)
- R WOW Generic Not Active (in air)
- Aircraft is ≤ 400 ft. AGL (radio altimeter)

The Landing Inhibit is cleared when any one (or more) of the following conditions occurs:

- 30 seconds after the L WOW Generic becomes active (on ground)
- 30 seconds after the R WOW Generic becomes active (on ground)
- (L Throttle is idle or R Throttle is idle) & (L WOW Generic is active or R WOW Generic is active) & (L ADC IAS ≤ 40 knots or R ADC IAS ≤ 40 knots)
- Aircraft is >400 ft. AGL (RAD ALT)
- Left and right displayed airspeed goes invalid.
- Radio Altimeter data goes invalid

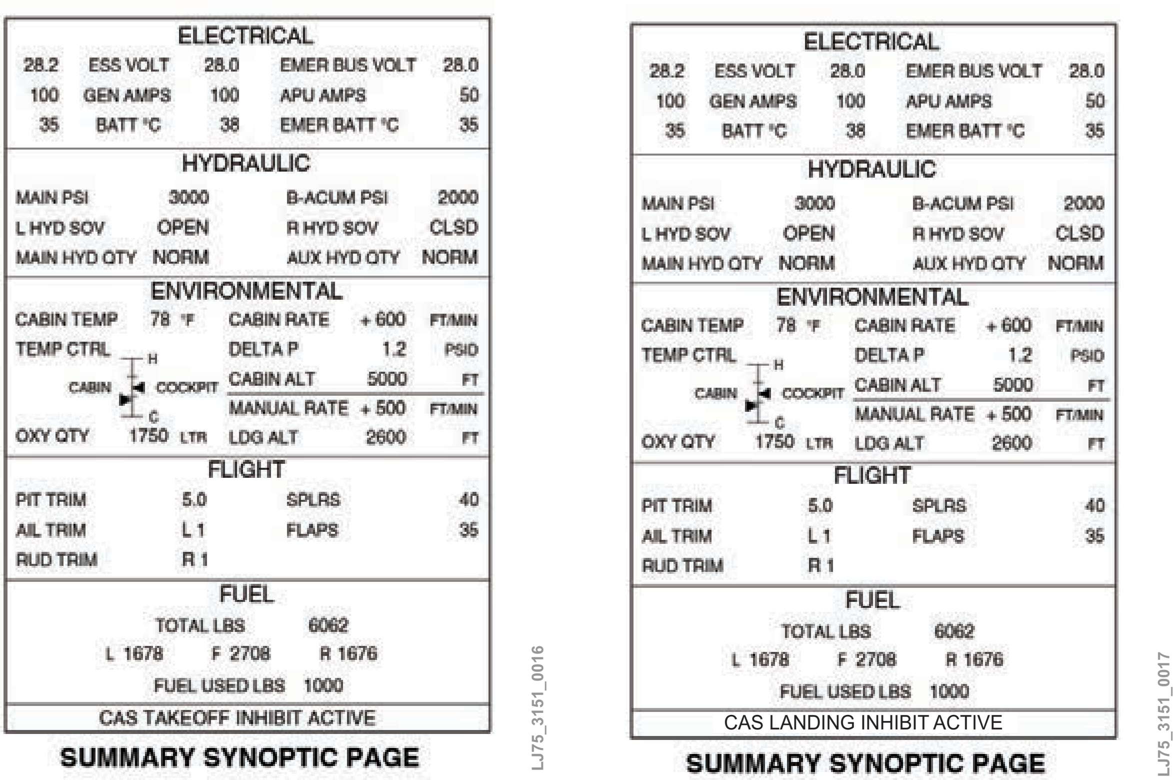


Fig. 32: CAS Takeoff/Landing Inhibits

FAULT INDICATION

Table 1: Central Computing System – CAS Messages

CAS MESSAGE	LOGIC
DAU 1 FAIL	GEA 1 has failed
DAU 2 FAIL	GEA 2 has failed
DAU 3 FAIL	GEA 3 has failed
DAU 4 FAIL	GEA 4 has failed
DAU 5 FAIL	GSD 1 has failed
DAU 6 FAIL	GSD 2 has failed
DAU 5 FAULT	GSD temperature is too low or needs service or GSD 1 is over temperature
DAU 6 FAULT	GSD temperature is too low or needw service or GSD 2 is over temperature

This page intentionally left blank

CONFIGURATION MONITOR SYSTEM

(ATA 31-53-00)

OVERVIEW

The configuration monitor system is a function contained in the integrated avionics unit (GIA) (ATA 31-41-00). This system is integrated with the EICAS (ATA 31-51-00) to provide the flight crew with aural and visual warnings when an unsafe condition exists.

The integrated avionics unit (GIA) generates the master warning tone (triple chime) and the non-mutable voice message “Configuration” that are transmitted over the audio system to both flight crewmember’s headphones and the cockpit speakers.

Associated Components

The configuration monitor system includes the following:

- Integrated avionics units

SYSTEM OPERATION

Table 4

The Takeoff Configuration Monitor System is used in conjunction with the Crew Warning System to provide aural and visual alerts on the ground when an unsafe takeoff configuration exists.

The non-mutable “CONFIGURATION” voice message is supplied to both pilots’ headphones and the cockpit speaker. This alert continues to sound until the unsafe condition is corrected, the takeoff is aborted or the aircraft becomes airborne. This is a priority one message that is not mutable. The configuration alert triggers when either throttle is >82%, the aircraft is on the ground, and one of the following conditions is met:

- Park brake is set
- Flaps are not at 8 or 20 degrees
- Primary pitch trim position is outside of the acceptable takeoff range
- Pitch trim bias switch is not in neutral position
- The absolute difference between the primary trim position and the secondary trim position exceeds 1.1
- Aileron trim is outside of the acceptable range· Rudder trim is outside of the acceptable range
- Thrust reversers are unlocked or deployed
- Spoilers are not fully retracted
- Secondary pitch trim position is outside of the acceptable takeoff range

The sensor inputs for the takeoff configuration monitor system input into the GIAs and GEAs. Table 4 lists each of the takeoff configuration monitors inputs and the respective G5000 LRU that processes the input.

Table 4: Takeoff Configuration Messages

LRU	INPUT
GIA 1	SPOILER POSITION LEFT T/R POSITION LEFT THRUST > 82% LEFT WOW GENERIC
GIA 2	RIGHT T/R POSITION RIGHT THRUST > 82% RIGHT WOW GENERIC
GEA 1	AILERON TRIM POSITION PRIMARY PITCH TRIM POSITION LEFT FLAP POSITION
GEA 2	RUDDER TRIM POSITION SECONDARY PITCH TRIM POSITION
GEA 3	PITCH TRIM POSITION PARKING BRAKE POSITION

The logic for the takeoff configuration monitor resides in each of the GDUs (Display Units). However, GDU 1 normally performs the takeoff configuration monitor function. In the event of loss of GDU 1, then GDU 3 assumes the takeoff configuration monitor function. In the event of loss of GDU 3 also, then GDU 2 assumes the takeoff configuration monitor function.

When the takeoff configuration warning activates there are additional associated cues displayed to inform the crew of which parameter exceedance(s) activated the warning. These are listed below in Table 5.

Table 5: Takeoff Exceedance Messages

ANNUNCIATION/CAS MESSAGE	LOGIC
TAKEOFF TRIM	Either aileron, rudder or pitch trim is not in takeoff band. Associated out of band trim digits are displayed in red.
EMER/PARK BRK	Park brake is set.
SPOILERS EXT	Spoilers are extended.
PIT TRIM MSCMP	Miscompare between primary and secondary pitch trim values.
PIT TRIM BIAS	Pitch trim bias is not in neutral position.
UNL/DEP	Above n1 display indicating thrust reversers are not stowed.
FLAP	Digital readout indicating flaps are not at 8 or 20 degrees.

Table 6: Configuration Messages

PREVIOUS MESSAGE	THROTTLES ADVANCED, “CONFIGURATION” VOICE MESSAGE ACTIVATED
TAKEOFF TRIM	Either aileron, rudder or pitch trim is not in takeoff band. Associated out of band trim digits are displayed in red.
EMER/PARK BRK	Park brake is set.
UNL/DEP	Unlocked or deployed indications are displayed above N1 on EICAS.
LR REV UNSAFE LIGHTS	Left or right unsafe lights illuminate on the crew warning panel.
FLAP PARAMETERS	Boxed in red.
SPOILER PARAMETERS	Boxed in red.
SPOILERS EXT	Spoilers extend.
PITCH, AILERON OR RUDDER TRIM PARAMETERS (NOT IN TAKEOFF BAND)	Boxed in red.
PITCH TRIM BIAS	Pitch trim bias.

This page intentionally left blank

ELECTRONIC FLIGHT INSTRUMENT SYSTEM

(ATA 31-60-00)

OVERVIEW

The electronic flight instrument system (EFIS) displays flight information for the pilot and copilot. The EFIS is integrated with the engine indicating and crew alerting system (EICAS) to provide the crew flight monitoring indications and caution, warning, and advisory messages, which alert the crew to potential out-of-tolerance parameters.

The flight data is provided through the primary flight displays (PFD 1 and PFD 2) and the multifunction display (MFD).

COMPONENTS

Figure 33

The EFIS is comprised of the following sub-systems:

- Display units (GDUs) (3)
- Touch controllers (GTCs) (2)
- Remote controllers (GCUs) (2)

Associated Components

- DU/reversion/dimming control panel
- Integrated avionics uits (GIAs) (2)
- P11 panel

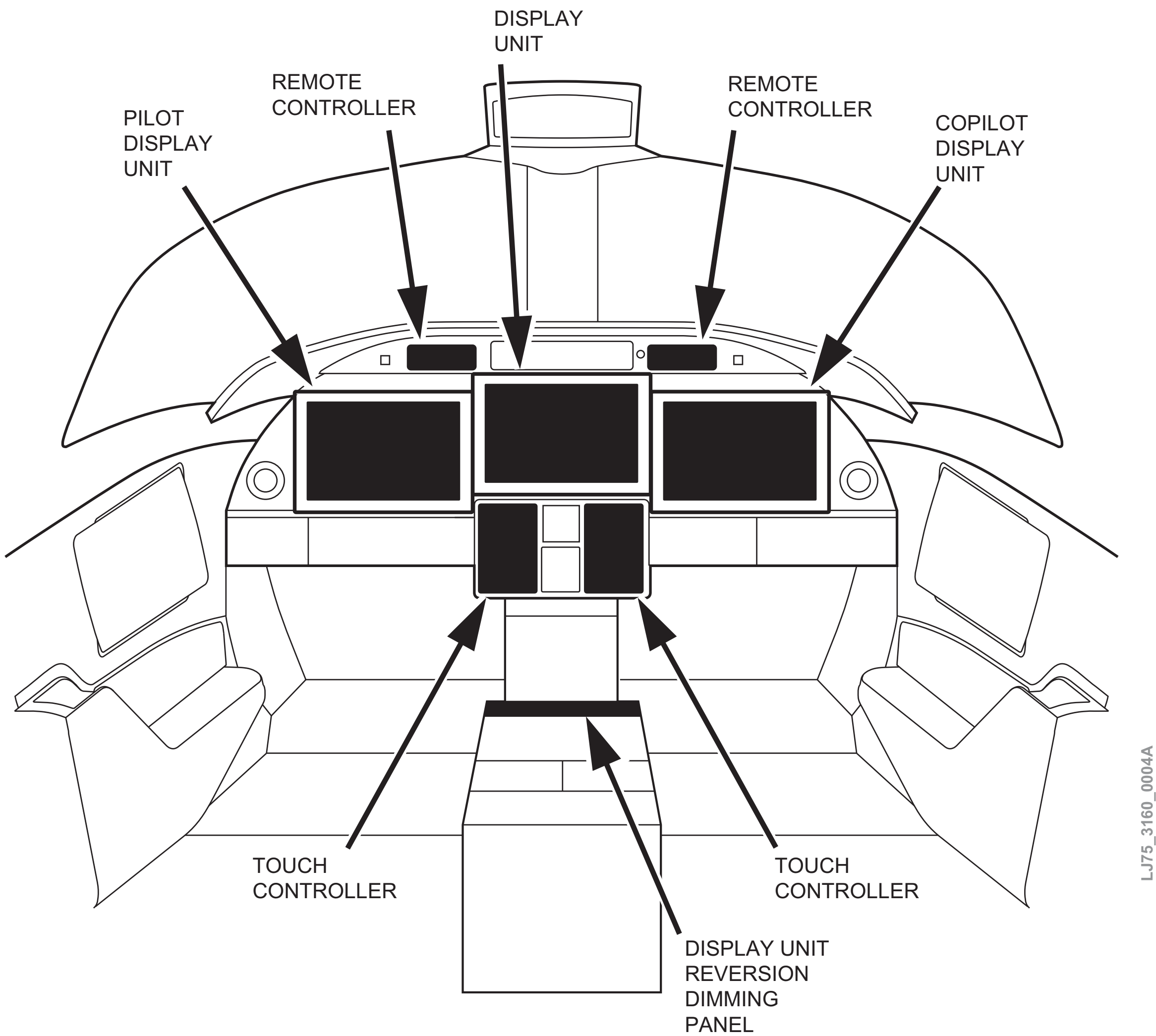


Fig. 33: System Components

COMPONENT DESCRIPTION

Display Units

Figure 34

The GDU 1400W features a 14-inch light emitting diode (LED) backlit widescreen display with a 1280 x 800 resolution.

The unit installed on the left/pilot side is designated as GDU1. In normal operations, it shows a Primary Flight Display (PFD), and may also show a display pane and a PFD.

The center unit is designated as GDU2. In normal operations it shows the Engine Indication and Crew Alerting System (EICAS) display, in addition to one or two display panes.

The unit installed on the right/copilot side is designated as GDU3. In normal operations, it shows a PFD, and may also show a display pane and a PFD.

The GDUs communicate with each other, the Touchscreen Controllers, and with the on-side GIA 63W Integrated Avionics Unit (IAU) through a High-Speed Data Bus (HSDB) Ethernet connection.

There are 12 softkeys along the bottom bezel of the display units (DUs). Depending on the display mode, a subset of the softkeys may be used. The softkeys shown depend on the softkey level. Each softkey either controls a specific item or accesses a lower level of softkeys. For softkeys that provide a specific control, the status of the control is annunciated on the softkey label, either via an on/off indicator or via text (for items where the control has multiple states).

There are two secure digital (SD) card slots in the top right portion of the display bezels of the display units.

See Secure Digital Cards (ATA 31-40-00) for more information.

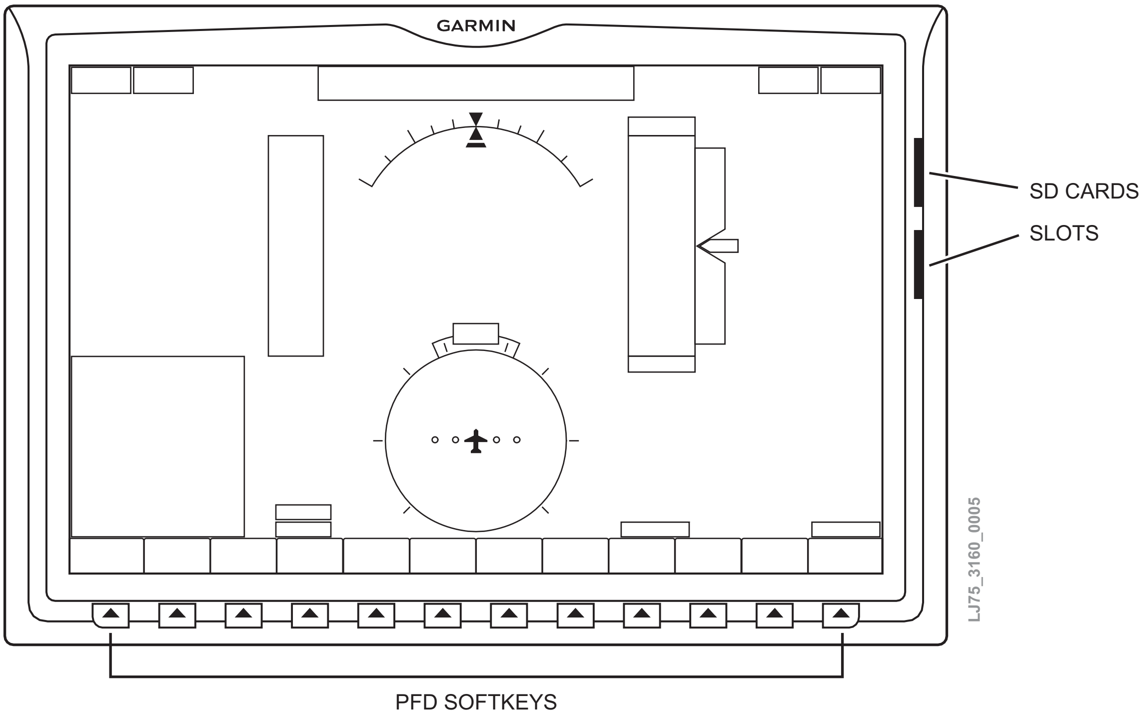


Fig. 34: Display Units (GDUs)

Touch Controllers

Figure 35

The touch controllers provide access to a wide variety of system capabilities including control of GDU display panes, Flight Management System (FMS) functions, communications, navigation, and surveillance systems, system status, and setup.

The unit installed on the left/pilot side is designated as GTC1, and the one installed on the right/copilot side is designated as GTC2. Each Touch Controller communicates with the on-side GDU in addition to GDU2 using an HSDB connection.

Each touch controller (GTC) uses one 8-position joystick with rotary knob and push capabilities, one dual-concentric knob with push capability, and one small single knob with push capability, often referred to as the "volume" knob.

The top section of the GTC touchscreen is known as the "radio bar." The radio bar, a dedicated area, is always accessible on the GTC and provides immediate access to COM tuning, transponder identification and tuning, and selected audio functions.

The center section of the display is known as the "desktop." The desktop has a set of "home" icons that primarily provide MFD and GTC page navigation. The buttons and icons shown in this area change as different GTC pages are selected. The buttons and icons control adjustments to settings, data entry, and page navigation.

The bottom row of the desktop is the "button bar" that is continuously displayed on all desktop pages. The button bar provides the location for buttons such as BACK, HOME, MSG, FULL screen view, and ENTER. All pages except for the HOME page have a BACK key that goes back one page and a HOME key that goes back to the HOME desktop page from anywhere. Each page on the desktop has a page title located at the top center of the desktop area.

The bottom section of the display is reserved for labeling the current function of the physical knobs. The table below defines the general default functions performed by each control on the GTC. The "label" column shows the label presented above the control on the display.

The GTCs provide display control, com/nav tuning/display, audio control/display, TOLD data entry, and flight planning. The touch controllers provide pilot interactivity within fully integrated units. Aural feedback for a valid or invalid input is provided through headsets and speakers. Visual feedback for a valid input is provided on the touch controller. The aural and visual feedback mechanisms provide system acknowledgement to the pilot.

The GTC pages are classified into three types of pages. These types define the relationship between the GTC and MFW.

The first type of page has no effect on the MFW. The pages that are this type are:

- Satellite link
- Nearest waypoint information
- Utilities
- Flight
- plan
- PERF
- Procedures
- D–> (direct to)

The second type will automatically change the MFW. The MFW will remain displayed independently of the GTC page until another MFW is selected. The pages that are this type are:

- Map
- Charts
- Aircraft systems
- Weather
- Traffic
- TAWS
- CPDLC

Selecting the third type of page will automatically change the MFW. Once this page is exited, the MFW will retain the last map selected. The only page that is this type is the Checklist page.

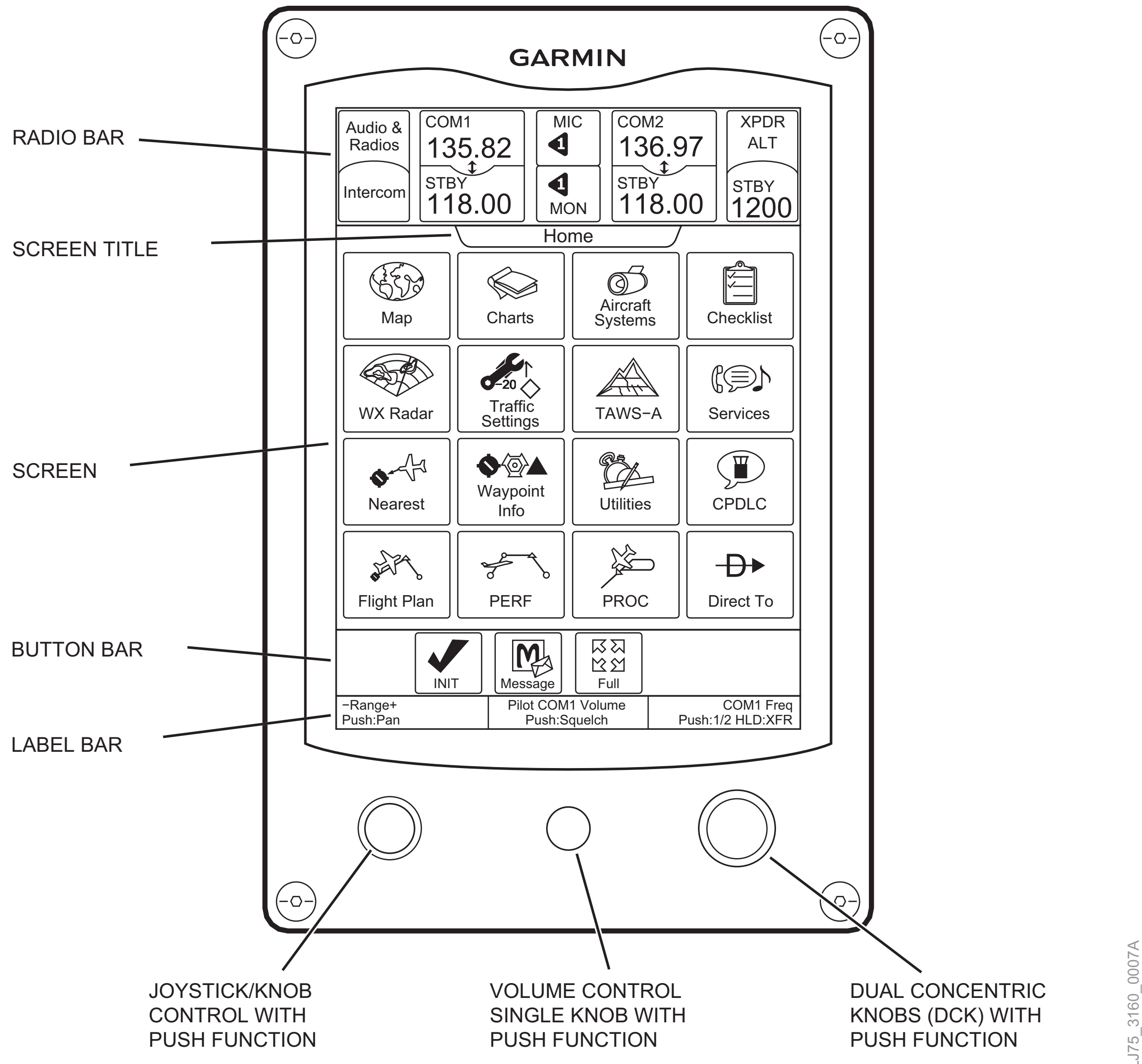


Fig. 35: Touch Controller

Remote Controllers

Figure 36

The remote controller (GCU) is a panel-mounted user interface which enables the flight crew to control the on-side PFD. The unit installed on the left/pilot side is designated as GCU1, and the one installed on the right/copilot side is designated as GCU2. Each unit is connected to the on-side GDU1 and to the GDU2 using an RS-232 connection.

Two remote controllers provide secondary control for the touch controllers. The GCUs provide inset map panning and ranging, adjust the barometric setting, and access often-used and high-workload flight planning functions such as the active flight plan on the lower right inset window on the PFDs. The GCUs also control the MFD unit when it is operating in reversionary mode and presenting primary flight information.

The functions of the GCUs are as follows:

Range/pan joystick—Changes the PFD inset map range, selects fields, and controls the map cursor.

BARO knob—Controls the barometric pressure setting to aid in altitude calibration. When the BARO knob is pushed, the barometric setting reverts to standard. The BARO function is displayed below the altitude tape.

Direct to button—Provides access to the direct-to function, which allows the pilot to enter a destination waypoint and establishes a direct course to the selected destination.

FPL button—Allows the pilot to create, edit, activate, and invert flight plans, as well as access approaches, departures, and arrivals.

CLR button—Erases information or cancels an entry.

PROC button—Allows the pilot to select approaches, departures, and arrivals for the flight plan.

ENT button (or push function of the dual concentric knobs)—Approves an operation or complete data entry.

PFD inner knob—Enters edit mode if the highlighted field is editable and the page is not currently in edit mode and changes the highlighted part of the field that is highlighted if the field is in edit mode.

PFD outer knob—Changes which field is highlighted if the page highlight is showing and the field is not in edit mode and changes the edit cursor location within the field that is highlighted if the field is in edit mode.

COM/NAV button—Displays a window which allows the cursor to be moved onto the COM or NAV frequencies to edit them.

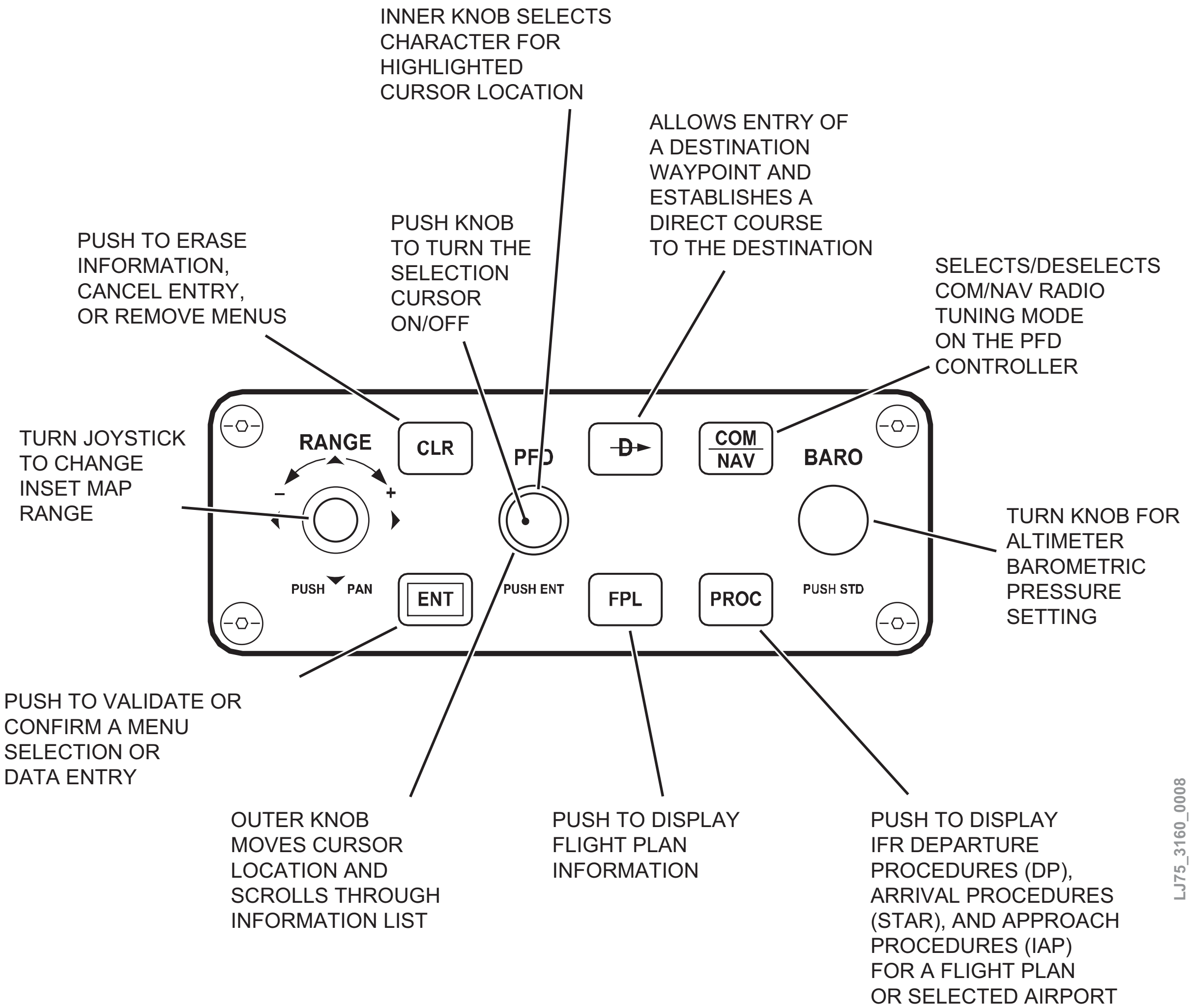


Fig. 36: GCU Remote Controller

DU Reversion/Dimming Panel

Figure 37

The DU reversion/dimming panel is the primary operational control of the display format. Each DU outer control knob selects the OFF, NORM, and PFD/MFW of each DU. The inner DU knobs control dimming and the AUTO setting. The GTC 1 and GTC 2 knobs have an OFF through AUTO dim selection. The STBY INSTR knob allows selections from DIM to BRIGHT. The SW/IND knob has two selections, DIM and BRT.

The display format of the dimming panel is defined into two configuration operations:

- Normal
- Reverted

The NORM position for DU 1 and DU 3 is a full PFD format. DU 1 and DU 3 can be commanded to a 60/40 format independently using their respective PFD/MFW control position. Each DU switch control position is independent for each DU. In normal operation, the DU 2 control position does not affect DU2 display format. If selected to PFD/MFW, a white DU 2 PFD/MFW CAS message shall be posted.

Reverted operation is defined as having any one or multiple display failures or adverse functionality. There is no auto reversion for the DUs from the NORM position. For a loss or improper functionality on the DU reversion / dimming panel, turn the DU outer control knob OFF.

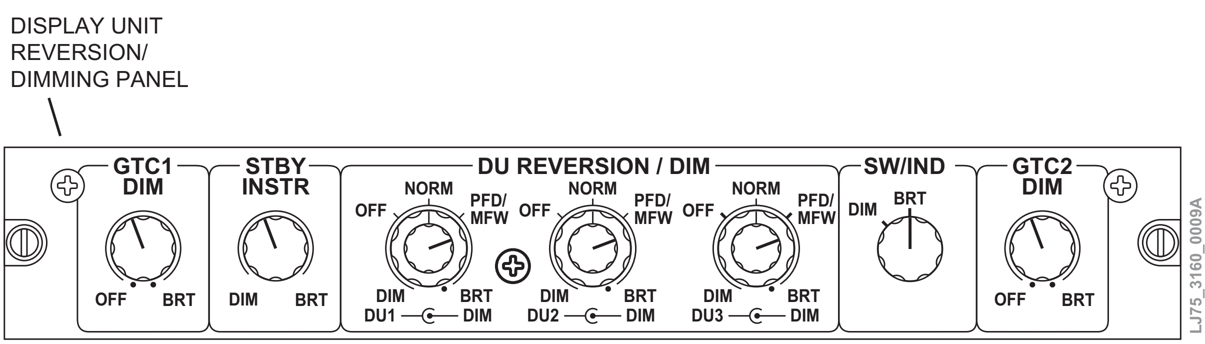


Fig. 37: DU Reversion/Dimming Panel

Integrated Avionics Units

For EFIS functions, the GIAs prioritize and generate the aural alerts which are then processed by the audio processor units.

P11 Panel

The P11 panel contains relays associated with switching for the EFIS system. P11 is located forward of DU2.

SYSTEM OPERATION

Figures 38, 39, 40, 41, 42, and 44

In normal operation mode, the PFD displays graphical flight instrumentation (for example, attitude, heading, airspeed, altitude, vertical speed, static air temperature (SAT), AFCS and navigation status data, selected communication data, etc). The MFD displays a full-color moving map with navigation information, as well as flight plan, weather, traffic, and terrain information. The left portion of the MFD is dedicated to the EICAS. Refer to the related display source systems for all specific PFD and MFD displays.

The multifunction window is primarily displayed on the center display. However, the MFD can be selected on either PFD when in PFD/MFW mode. The center display (DU 2) could show two MFDs at one time or a single large display MFD. This includes, but is not limited to, charts, maps, weather, terrain, traffic collision avoidance system (TCAS), flight planning, documents, synoptics, and diagnostics.

The EICAS window shows full-time in the cockpit. The primary location is on the center display unit (DU 2). If a display failure occurs, the EICAS window can be recovered by reverting one or two of the DUs in operation to the PFD/MFW mode. The EICAS strip is then changed to a 60/40 presentation. Refer to (31-51-00) for the EICAS description and operation section.

The EFIS also includes the displays that follow:

- Flight Plan Profile Overlay
  - The profile view is an additional map displayed below the standard navigation map on DU 2. This map is designed to show relative vertical positioning of terrain and objects relative to the aircraft in order to increase vertical situational awareness.
- Electronic Charts
  - Each DU independently provides electronic Jeppesen charts (terminal procedures charts). The charts show in full color with high resolution. The MFD depiction shows the aircraft position on the moving map in the plan view of approach charts and on airport diagrams. The ChartView database subscription is available from Jeppesen and the available data includes the arrivals (STAR), departure procedures (DP), approaches, airport diagrams, and notices to airmen (NOTAMs). Charts are geo-referenced (an airplane spotter is shown over the chart where appropriate).
  - Activation of the Jeppesen ChartViews require the use of an enable card to be inserted into the SD card slot on PFD 1 with all displays energized. Once activated, the unlock card becomes linked to the particular aircraft. The navigation database is downloaded to a single card (per the Jeppesen database update process) and then loaded to the internal memory of each DU.

- Moving Maps
  - The moving map feature gives moving navigation maps in relation to an aircraft depiction.
- Digital Clock and Timer
  - GPS-synchronized clocks, with count-up and count-down capabilities, are integrated into each PFD. Timers can be set by the crew. Aural alerts activate when the time has expired.
- Angle of Attack (AOA) Depiction
  - An on-side AOA depiction, presented in a similar manner to the previous AOA dials, are integrated into each PFD.
- SafeTaxi
  - A safe taxi overlay gives greater map detail when airports are viewed at close range. It can show taxiways with identifying letters/numbers, airport hot spots, and airport landmarks including ramps, buildings, control towers, and other prominent features. Airport hot spots are outlined to caution pilots of areas on airport surfaces where positional awareness confusion or runway incursions happen most often.
- Aircraft Owners and Pilots Association (AOPA) Directory Display
  - The airport directory gives an interface via the MFD to AOPA directory information (facility hours of operation, pattern altitude, runways, lighting, fixed-base operators (FBOs), and other information).

MFD Displays - Full/Half Mode Operation

- The touch controllers give easily-accessible MFD control to the pilot and copilot. This area of the MFD includes everything to the right of the EICAS display and includes maps, flight planning, and systems information.
- Certain buttons on the GTCs are associated with activating specific displays on the MFD. When one of these buttons is touched on either GTC, the MFD shows a corresponding display.
- After system power-up, the MFD shows the Navigation Map Display and the Traffic Map Display in a side-by-side format in Half mode. In Half mode operation, the left half of the MFD (excluding the EICAS display), is associated with the GTC 1 (or pilot side); the right portion is associated with GTC 2 (or copilot side). Either GTC may be used to select and control a display on its respective MFD.
- In Half mode, the GTC 1 and GTC 2 retain independent settings for their respective display, half being controlled, which allows greater flexibility. For example, both the left and right MFD halves can give a Navigation Map display, but with different map orientations or overlay data based on the flight crew preferences on each half. During normal operation, the system continues to operate in Half mode until Full mode is selected on either GTC. The Full mode is selected via the Full button in the GTC Button Bar. When the Full button is touched, the related GTC MFD half display expands to a full display.

- The GTC that enabled the Full mode has the ability to change the selected display settings while operating in Full mode with the use of the Map Settings button. However, either GTC joystick may be used to adjust the map range or activate the map panning function, when available. The Label Bar on the GTC indicates the availability of these functions.
- The system also automatically enters the Half mode if the GTC which did not select Full mode is used to select another MFD display or if either GTC selects an MFD display which can only be presented in Half mode (such as the aircraft systems displays).
- On the Home screen, the buttons on the top row (Map, Traffic, Datalink Weather, and TAWS-A) are each associated with a corresponding map display on the MFD. When one of these buttons is touched, the MFD shows the associated map display and the GTC button border is highlighted in light blue to indicate the map associated with the button is selected for display. When returning to the Home screen, the map associated with the highlighted button is displayed.

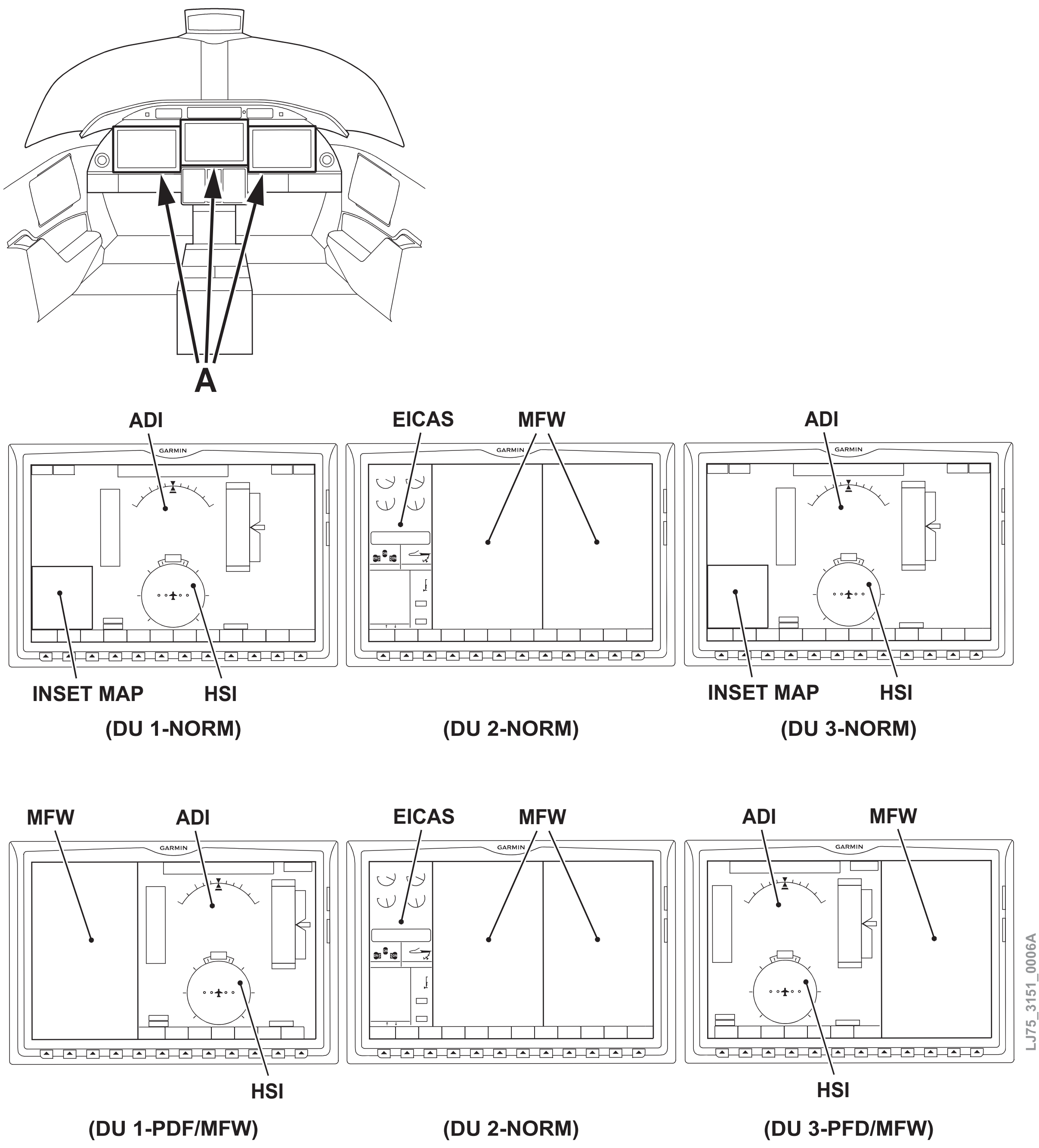


Fig. 38: Normal Display Configurations

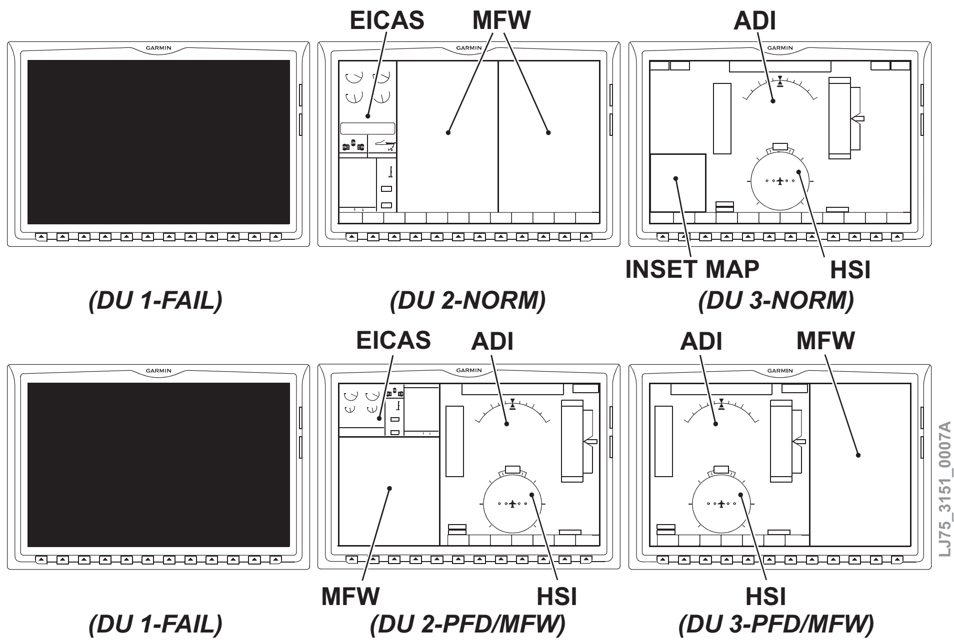


Fig. 39: Display Unit 1 Failure Configurations

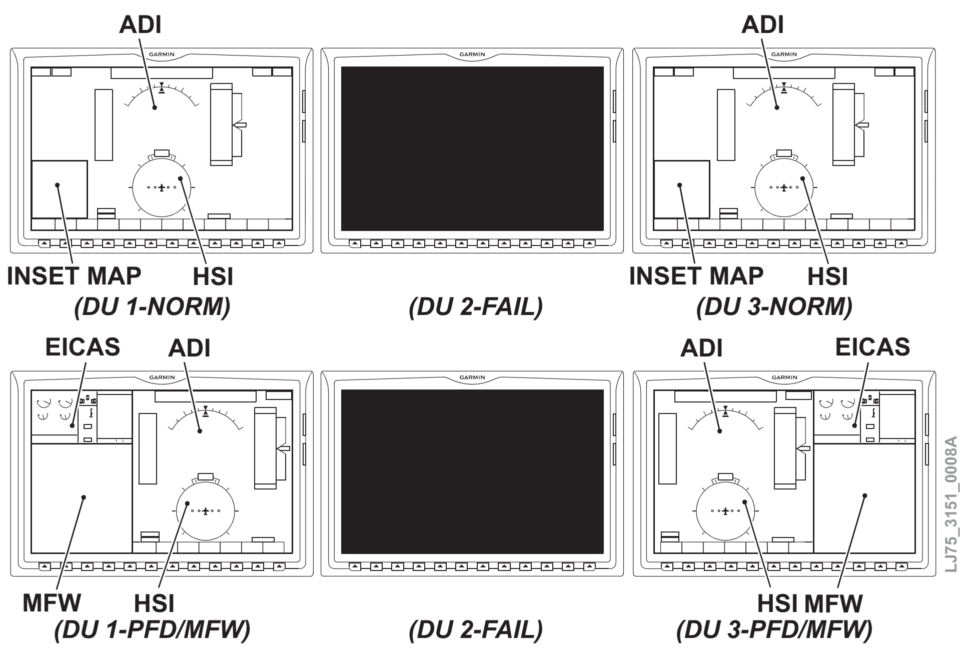


Fig. 40: Display Unit 2 Failure Configurations

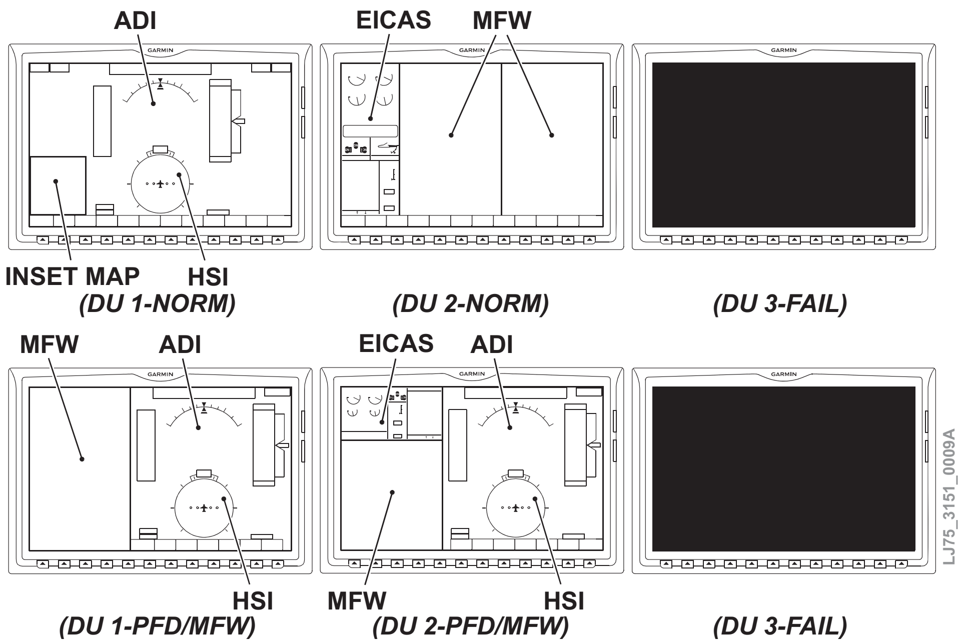


Fig. 41: Display Unit 3 Failure Configurations

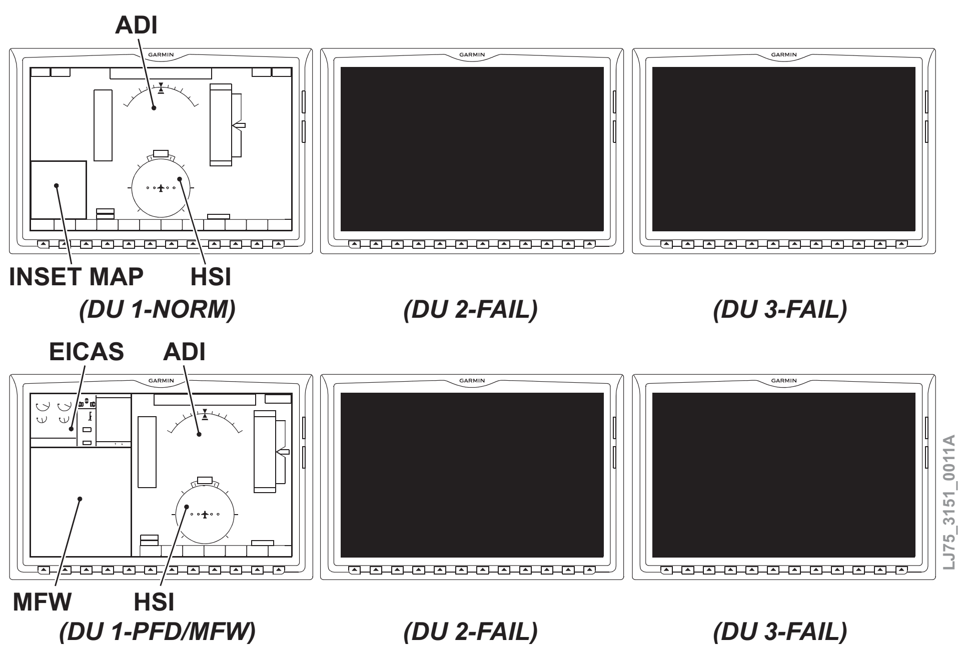


Fig. 42: Multiple Display Units Failure Configurations

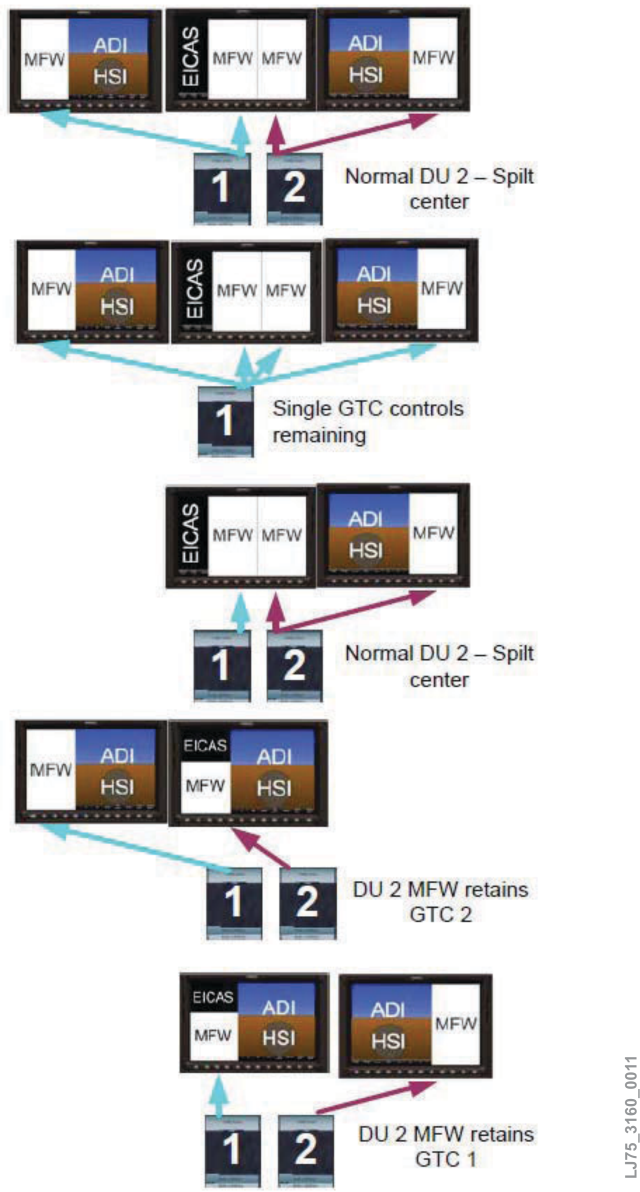


Fig. 43: MFW Controls – DU and GTC Failures

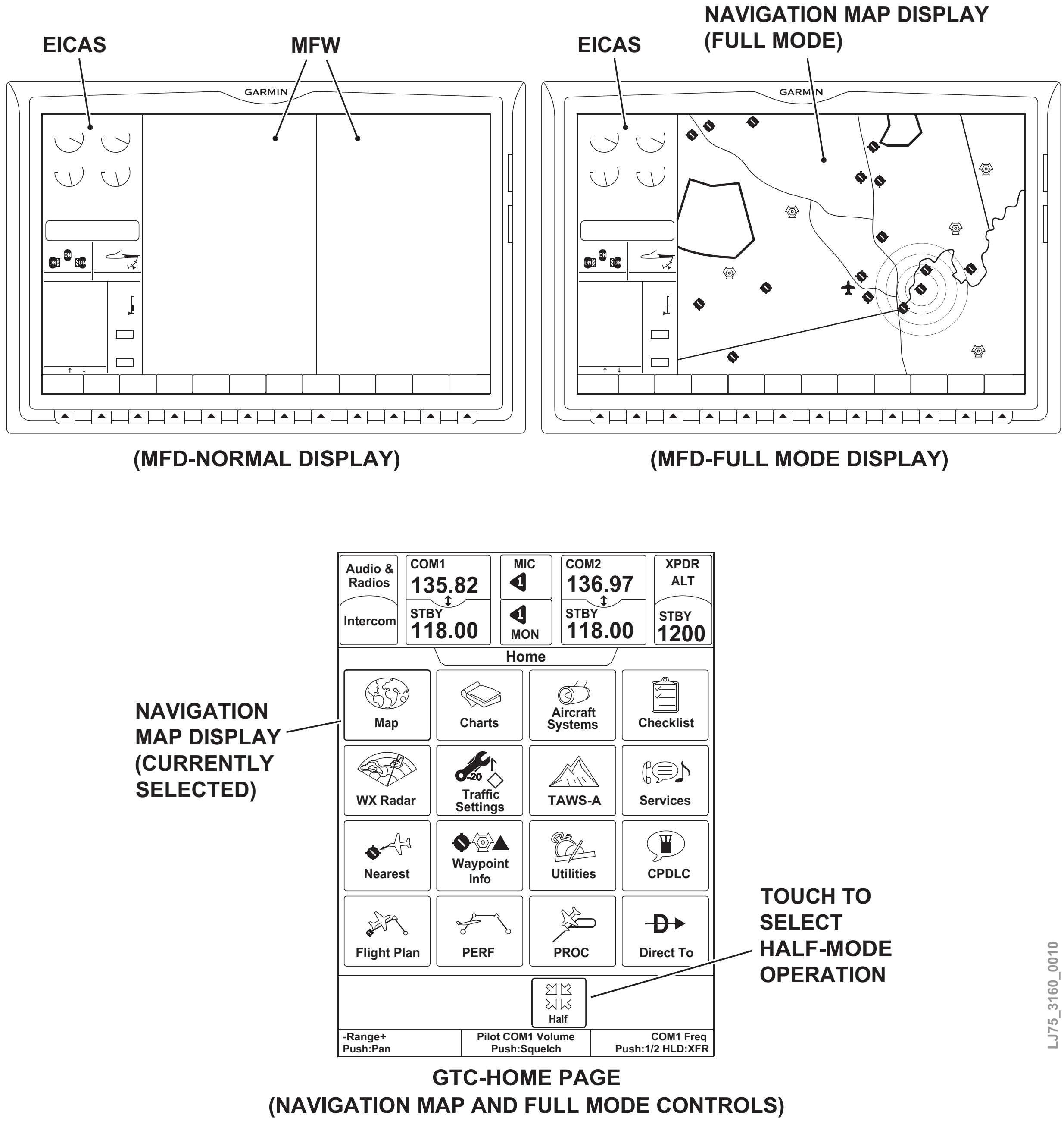


Fig. 44: MFD and GTC Home Page Locator

SYSTEM INTERFACE

Interfaces

Display unit no. 1 interfaces directly with the onside data concentrator, integrated avionics unit, air data computer, and attitude heading and reference unit.

Display unit no. 3 interfaces directly with the onside integrated avionics unit, data concentrator, air data computer, and attitude heading and reference unit.

Display unit no. 2 interfaces directly with air data computer no. 1 and attitude heading and reference unit no. 1.

The touch controllers interface directly with the onside audio processor units.

Cross-side interface is available for the components of the EFIS system via the high-speed databus.

In normal operation, GIA 1 and DU 1 communicate via HSDB and DU 1 communicates with GTC 1 via HSDB. In this scenario GIA 1 and GTC 1 are in communication via HSDB.

In case of a DU 1 power failure, the HSDB wiring between GIA 1 and DU 1 gets rerouted to GTC 1. In this scenario no data is lost from GIA 1. This happens automatically via a relay located in the P11 panel.

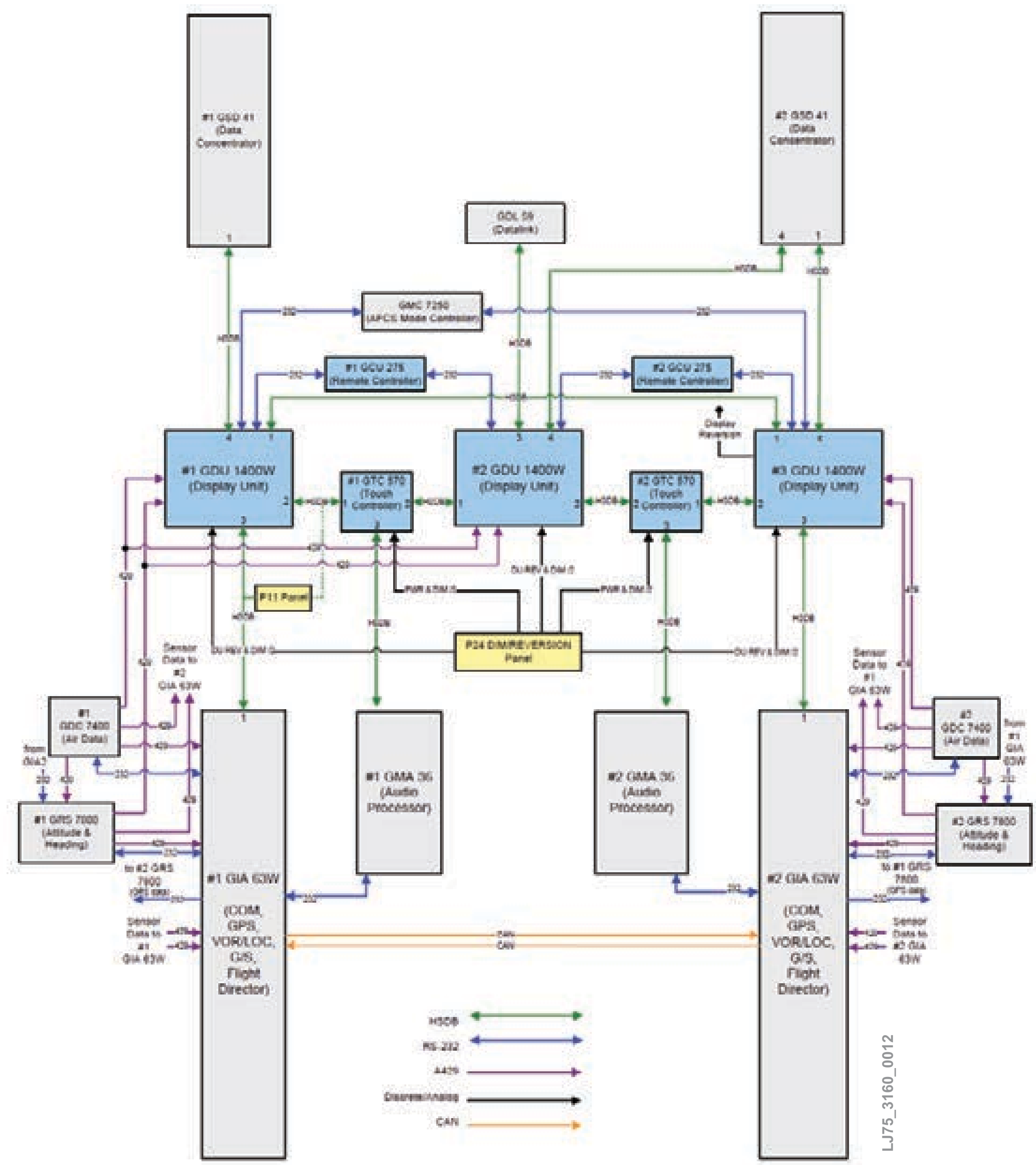


Fig. 45: EFIS Architecture Block Diagram

Power

DU 1 is powered through a circuit breaker on the L ESS AV bus on the pilot circuit breaker panel. DU 2 is powered through a circuit breaker on the EMER BATT bus on the pilot circuit breaker panel. DU 3 is powered through a circuit breaker on the R ESS AV Bus on the copilot circuit breaker panel.

GTC 1 is powered through a circuit breaker on the EMER BATT bus on the pilot circuit breaker panel. GTC 2 is powered through a circuit breaker on the R ESS Bus on the copilot circuit breaker panel.

The pilot remote controller is powered through the L RMT CTRL circuit breaker on the left essential bus. The copilot remote controller is powered through the R RMT CTRL circuit breaker on the right essential bus.

Integrated avionics unit 1 is energized via the GIA 1 MAIN PRI circuit breaker (through the cockpit miscellaneous relay panel) (P11) from the left essential bus and via the GIA 1 MAIN SEC circuit breaker from the emergency battery bus on the pilot circuit breaker panel.

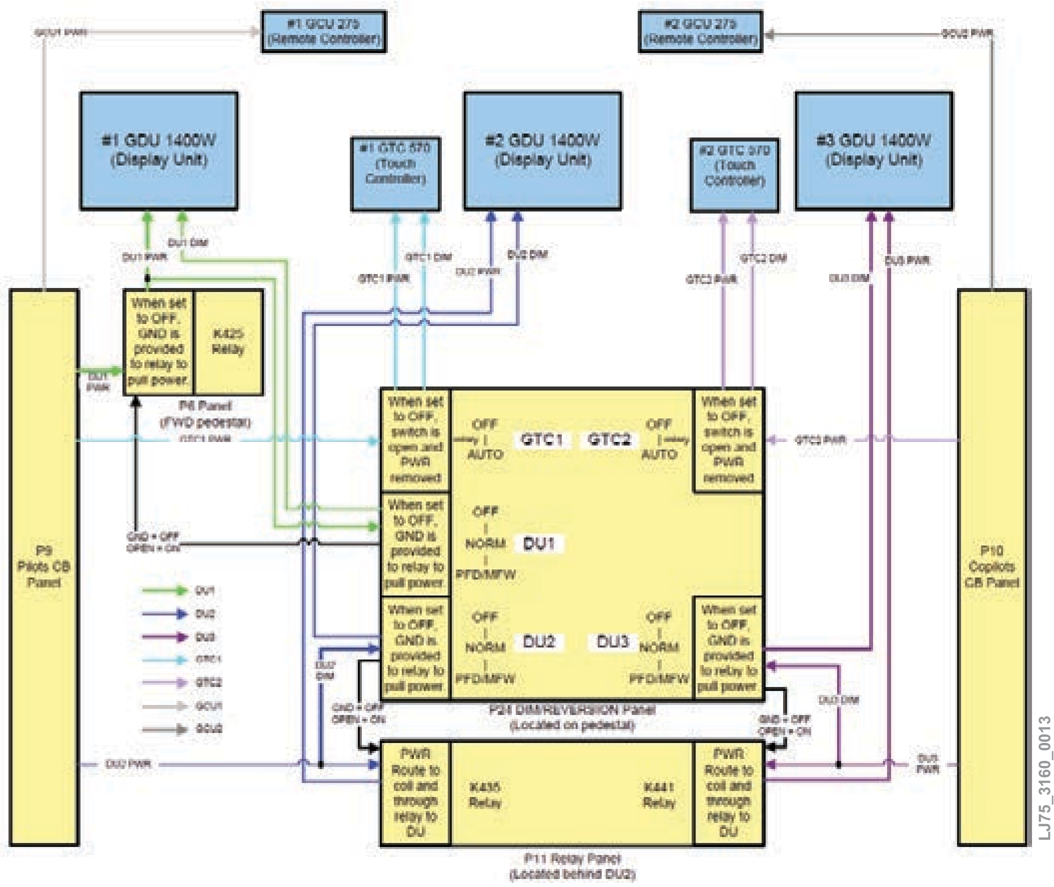


Fig. 46: EFIS Power and Control (P24)

FAULT INDICATION

Table 7: EFIS – CAS Messages

CAS MESSAGE	LOGIC
DU1 FAULT	The monitoring function detected that DU1 CGP is not functioning correctly.
DU2 FAULT	The monitoring function detected that DU2 CGP is not functioning correctly.
DU3 FAULT	The monitoring function detected that DU3 CGP is not functioning correctly.
L RMT CTRL FAIL	The left GCU has failed.
R RMT CTRL FAIL	The right GCU has failed.
LR RMT CTRL FAIL	Both GCU's have failed.
DU2 PDF/MFW	The format is restricted (reversion switch is in the wrong position).
GTC MESSAGE	Posted to the CAS strip when any of the associated system messages are posted to the GTC display

This page intentionally left blank

TABLE OF CONTENTS

NAVIGATION
(ATA 34-00-00)
INTRODUCTION 1

STALL WARNING SYSTEM
(ATA 34-10-00)
OVERVIEW 3
COMPONENTS 3
ASSOCIATED COMPONENTS 3
COMPONENT DESCRIPTION AND OPERATION 3
Angle-of-Attack Sensors 3
Static Inverters 5
Stick Shakers 6
ASSOCIATED COMPONENT DESCRIPTION AND OPERATION 8
Integrated Avionics Units (GIAs) 8
Flap Position Indication Unit 9
CONTROLS AND INDICATIONS 9
SYSTEM OPERATION 10
System Test 12
FAULT INDICATION 13
AOA INDICATOR AMBER X 14

PITOT-STATIC SYSTEM
(ATA 34-11-00)
OVERVIEW 15
COMPONENTS 15
COMPONENT DESCRIPTION AND OPERATION 15
Pitot-Static Probes 15
Drain Valves 16
SYSTEM OPERATION 17
Primary Pitot-Static System 17
Standby Pitot-Static System 17
Pitot Heat 17

RADIO ALTIMETER SYSTEM
(ATA 34-14-00)
OVERVIEW 19
COMPONENTS 19
ASSOCIATED COMPONENTS 19
COMPONENT DESCRIPTION AND OPERATION 20
Radio Altimeter Transceiver 20
Radio Altimeter Antennas 20
SYSTEM OPERATION
CONTROLS AND INDICATIONS 20
Fault Indication 23
Minimum Descent Altitude/Decision Height Alerting 24
SYSTEM INTERFACES 24
Power 24

AIR DATA SYSTEM
(ATA 34-17-00)
OVERVIEW 25
COMPONENTS 25
ASSOCIATED COMPONENTS 25
COMPONENT DESCRIPTION 25
Air Data Computers 25
TAT Probe 26
SYSTEM OPERATION 28
CONTROLS 28
INDICATIONS 28
AIRCRAFT INTERFACES 29
COMPARATOR ANNUNCIATIONS 32
FAULT INDICATION 33

ELECTRONIC STANDBY INSTRUMENT SYSTEM (ESIS)
(ATA 34-24-00)
OVERVIEW 35
COMPONENTS 35
ASSOCIATED COMPONENTS 35
COMPONENT DESCRIPTION 35
ESIS Display 35
Magnetometer 35
ASSOCIATED COMPONENT DESCRIPTION 35
Configuration Module 35

SYSTEM OPERATION ... 38
Self-Test ... 38
SystemID Splash Screen ... 38
Alignment ... 38
Normal Operating Mode ... 38
Controls ... 39
Indications ... 39
SYSTEM INTERFACES ... 39
Power ... 39
Signal Interface ... 39
Fault Indication ... 41

ATTITUDE HEADING REFERENCE SYSTEM (AHRS) (ATA 34-27-00)
OVERVIEW ... 43
COMPONENTS ... 43
ASSOCIATED COMPONENTS ... 43
COMPONENT DESCRIPTION ... 43
Attitude Heading Reference Units ... 43
Magnetometers ... 45
SYSTEM OPERATION ... 46
Indications ... 46
Modes of Operation ... 46
SYSTEM INTERFACES ... 46
Power ... 46
Primary ... 47
Secondary ... 47
Third Backup ... 47
Additional RS-232 Interfaces ... 47
Magnetometer Interfaces ... 47
FAULT INDICATION ... 50

RUNWAY/TAXIWAY SITUATIONAL AWARENESS (ATA 34-31-00)
OVERVIEW ... 51
COMPONENT DESCRIPTION ... 51
SD Card ... 51
SYSTEM OPERATION ... 51
SYSTEM INTERFACE ... 51

WEATHER RADAR SYSTEM
(ATA 34-42-00)
OVERVIEW 53
COMPONENTS 53
COMPONENT DESCRIPTION 53
Weather Radar RTA 53
SYSTEM OPERATION 55
Inputs 55
Weather Radar System 55
Display 56
Modes 56
SYSTEM INTERFACE 56
FAULT INDICATION 58

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS II)
(ATA 34-43-00)
OVERVIEW 59
COMPONENTS 59
ASSOCIATED COMPONENTS 59
COMPONENT DESCRIPTION 61
TCAS II Processor 61
TCAS II Antennas 61
ASSOCIATED COMPONENT DESCRIPTION 61
Touch Controllers 61
Transponders 61
SYSTEM OPERATION 61
Modes of Operation 61
Indications 62
POWER 64
FAULT INDICATION 65
System Status 65
TCAS II Failure Annunciations 66
TCAS II Traffic Status Annunciations 66

TERRAIN AWARENESS WARNING SYSTEM (TAWS)
(ATA 34-45-00)
OVERVIEW 67
ASSOCIATED COMPONENTS 67
COMPONENT DESCRIPTION 67
SYSTEM OPERATION 67
TAWS-A 67

Visual and Aural Warning Modes 68
Reactive Windshear Detection 70
TAWS Controls 71
Synthetic Vision Technology 71
SVT Display on the PFD 72
FAULT INDICATIONS 76

VHF NAVIGATION SYSTEM
(ATA 34-51-00)
OVERVIEW 77
COMPONENTS 77
Associated Components 77
COMPONENT DESCRIPTION 77
VHF Navigation Antennas 77
VHF Navigation Splitter 78
ASSOCIATED COMPONENT DESCRIPTION 78
Integrated Avionics Units 78
Glideslope Antennas 79
Audio Processor Units 79
Marker Beacon Antenna 80
Marker Beacon Splitter 81
Touch Controllers 81
Remote Controllers 82
Indications 83
SYSTEM OPERATION 83
VOR and Localizer Navigation 83
Power 86
FAULT INDICATIONS 87

GLOBAL POSITIONING SYSTEM
(ATA 34-53-00)
OVERVIEW 89
COMPONENTS 89
ASSOCIATED COMPONENTS 89
COMPONENT DESCRIPTION 89
Integrated Avionics Units (GPS Module) 89
GPS Antennas 89
SYSTEM OPERATION 91
AHRS 91
EICAS 91
Indications 91

Displays 92
Control 92
FAULT INDICATION 94

DISTANCE MEASURING EQUIPMENT (DME) SYSTEM
(ATA 34-55-00)
OVERVIEW 95
COMPONENTS 95
ASSOCIATED COMPONENTS 95
COMPONENT DESCRIPTION AND OPERATION 95
DME Transceivers 95
DME Antenna 96
SYSTEM OPERATION 96
FAULT INDICATION 98

ATC TRANSPONDER SYSTEM
(ATA 34-56-00)
OVERVIEW 99
COMPONENTS 99
ASSOCIATED COMPONENTS 99
COMPONENT DESCRIPTION 101
ATC Transponders 101
ATC L-Band Antennas (ATC1, ATC2) 102
ATC Ident Switches 103
Touch Controllers (GTC1, GTC2) 103
Integrated Avionics Units 104
CONTROLS AND INDICATIONS 104
SYSTEM OPERATION 105
General 105
Standby Mode 105
ON Mode 105
Altitude Reporting Mode 105
Ground Mode 105
Flight ID 105
Acquisition Squitter 105
Extended Squitter 106
TCAS Interface 106
Suppression Signal 106
Power 106
FAULT INDICATION 108

AUTOMATIC DIRECTION FINDER (ADF) SYSTEM
(ATA 34-57-00)
OVERVIEW ... 109
COMPONENTS ... 109
ASSOCIATED COMPONENTS ... 109
COMPONENT DESCRIPTION ... 109
ADF Receivers ... 109
ADF Antenna ... 110
SYSTEM DESCRIPTION ... 110
SYSTEM OPERATION ... 110
Control ... 110
Power ... 110

This page intentionally left blank

NAVIGATION

(ATA 34-00-00)

INTRODUCTION

The navigation chapter consists of flight environment data, attitude and direction, independent position determining, dependent position determining, and flight management.

The flight environment data system provides air data information and independent standby instruments for backup information if the primary systems fail.

The attitude and direction system provides attitude information and heading reference information to the aircraft.

The independent position determining system provides information to the flight crew relative to aircraft position, and is mainly independent of ground installation.

The dependent position determining system provides information to the flight crew relative to aircraft position and is mainly dependent on ground installations.

The flight management system provides flight crew with centralized control of the navigation sensors and convenient computer-based flight planning using an extensive navigation database and provide lateral and vertical navigation.

The Learjet 70/75 navigation system includes the following subsystems:

- Stall Warning System 34-10-00 (27-31-00 in AMM)
- Pitot/Static System 34-11-00
- Radio Altimeter System 34-14-00
- Air Data System 34-17-00
- Electronic Standby Instrument System 34-24-00
- Attitude Heading Reference System 34-26-00
- Landing and Taxiing Aids 34-30-00
- Runway/Taxiway Situational Awareness 34-31-00
- Weather Radar System 34-42-00
- Traffic Alert and Collision Avoidance System 34-43-00
- Terrain Awareness and Warning System 34-45-00
- VHF Navigation System 34-51-00
- Global Positioning System 34-53-00
- Distance Measuring Equipment 34-55-00
- Transponder System 34-56-00
- Automatic Direction Finder 34-57-00

This page intentionally left blank

STALL WARNING SYSTEM

(ATA 34-10-00)

NOTE

In the Learjet 70/75 Maintenance Manual, the Stall Warning System is ATA 27-31-00.

OVERVIEW

The dual stall warning system contains two completely independent systems, one each for the left side or pilot position and one for the right side or copilot position. The stall warning system gives the crew an indication of impending aircraft stall.

The stall warning system supplies signals for use by the visual indication system of low speed awareness, approach angle-of-attack, and the master warning system. The system receives airspeed, altitude, and flap position information from aircraft systems, and develops normalized angle-of-attack data reference for display on EFIS.

COMPONENTS

The stall warning system is comprised of the following components:

- Angle-of-attack (AOA) sensors (2)
- Static inverters (2)
- Stick shakers (2)

ASSOCIATED COMPONENTS

- Integrated avionics units (GIAs) (2)
- Flap position indication unit

COMPONENT DESCRIPTION AND OPERATION

Angle-of-Attack Sensors

Figure 1

A left and right angle-of-attack transmitter is installed on each side of the fuselage in the pressurized compartment. Power for the transmitters is provided by onside static inverters. An angle-of-attack vane is attached to each angle-of-attack transmitter. The angle-of-attack transmitter measures the direction of airflow with respect to the fuselage reference.

Ice protection is provided by an electric heater located near the outer surface of each stall vane. Power to the heaters is provided by AOA circuit breakers located on the pilot and copilot circuit breaker panels.

The replaceable stall vane is designed such that it will break away upon impact with flying object such as birds, while being retained by a hinge at its rear surface to prevent ingestion by the engines. If replacement of the vane is required, it can be accomplished without the need to remove or recalibrate the angle of attack transmitter.

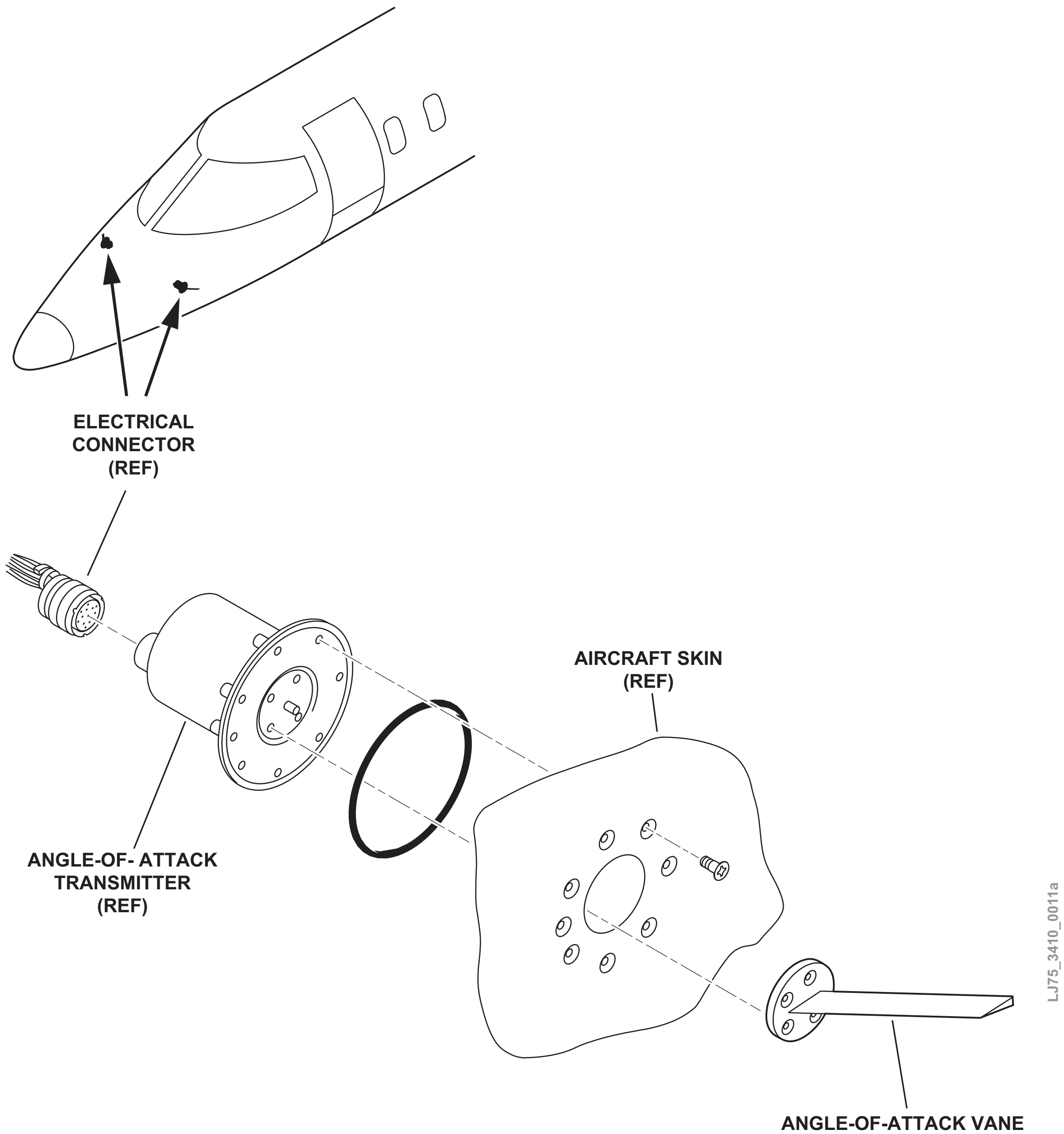


Fig. 1: Angle-of-Attack Sensors

Static Inverters

Figure 2

Two static inverters are installed in the aft nose avionics compartment and generate

26VAC 400Hz synchro reference signals for use in determining vane position of the angle of attack vanes. Power is provided by the stall warning circuit breakers on the pilot and copilot circuit breaker panels.

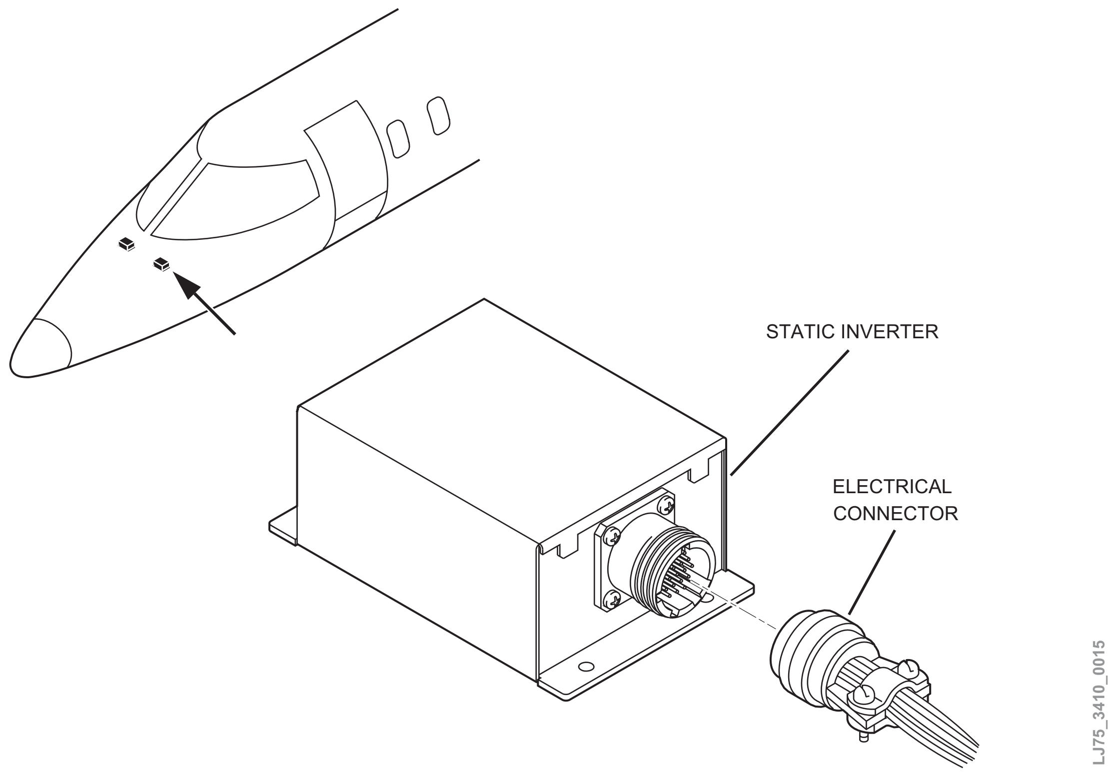


Fig. 2: Static Inverters

Stick Shakers

Figure 3

A stick shaker is installed on each control column. Operation of the impact stick shaker imparts a combination of shake and knock to the control column, simulating aircraft buffet by the shake. The tactile effect thus produced is sufficient to give the pilot proper warning.

The shaker consists of a 28 VDC motor drive eccentric mass, arranged so that the mass rotates around the striker assembly, to which it is flattened through a pivot assembly. In operation, the annulus housing the eccentric mass and the attached motor are driven by their reaction to the eccentric mass, to strike opposite sides of the cylinder alternately, making two such strikes for each rotation of the eccentric mass.

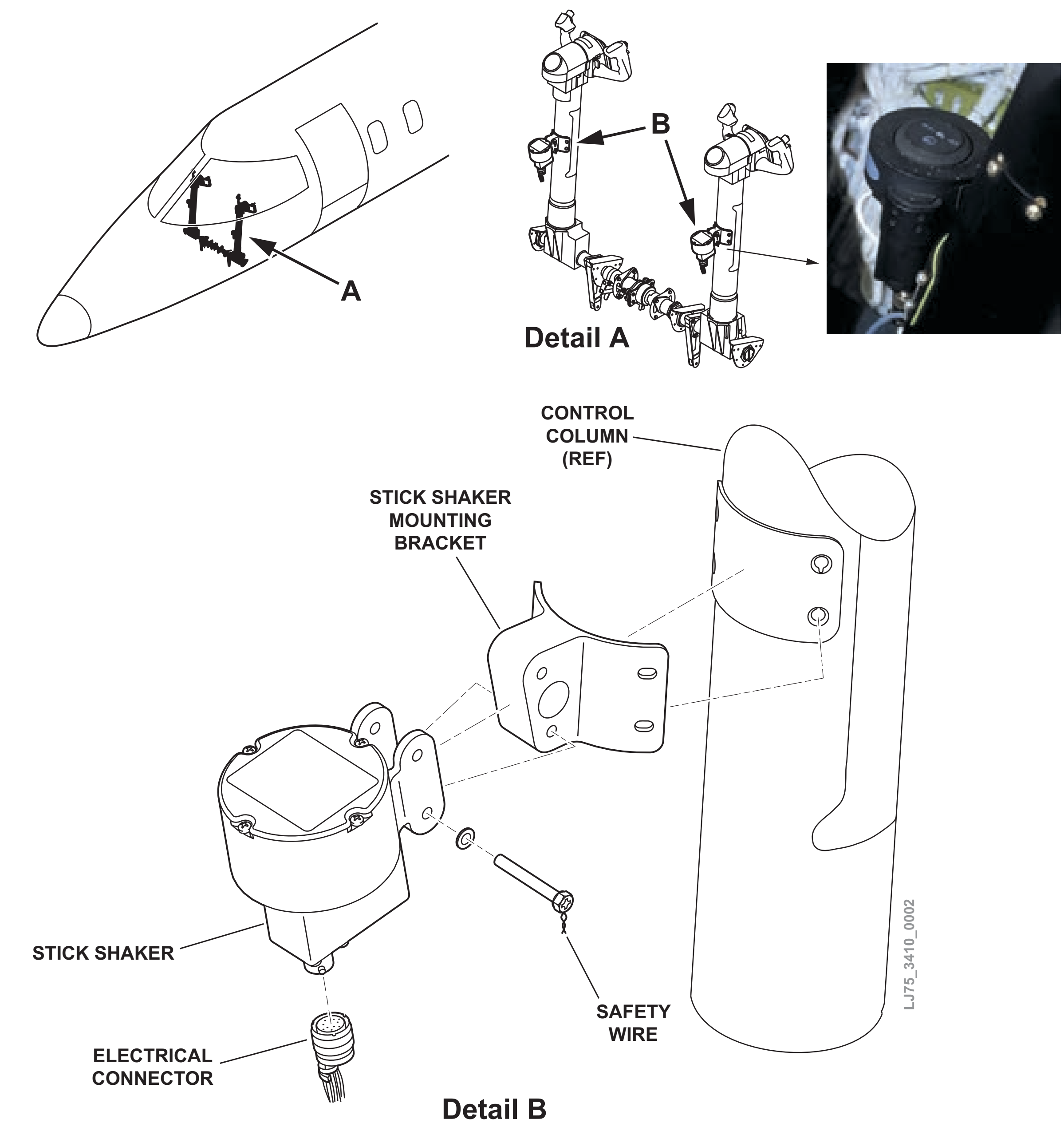


Fig. 3: Stick Shakers

ASSOCIATED COMPONENT DESCRIPTION AND OPERATION

Integrated Avionics Units (GIAs)

Figure 4

The GIAs are installed forward of the instrument panel (refer to Chapter 31).

Each GIA receives onside aircraft sensor data to perform its own independent stall warning calculation, which provides visual cues (low speed awareness and AOA indicators) on the primary flight displays, an aural tone, and activation of the pilot and copilot stick shakers.

The no. 1 stall warning computing function resides in the integrated avionics unit no. 1.

The no. 2 stall warning computing function resides in the integrated avionics unit no. 2.

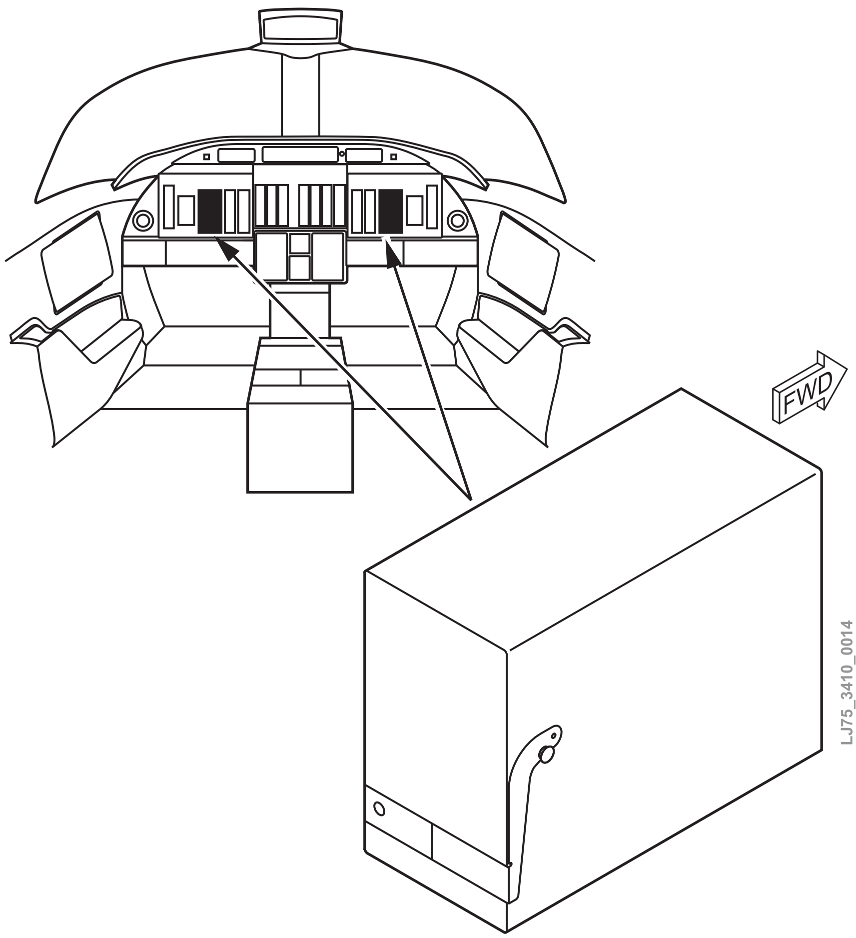


Fig. 4: GIAs

Flap Position Indication Unit

The flap position unit, located on the aft pressure bulkhead, gathers flap position from the wing mounted RVDTs and provides flap position information to the stall warning system.

Internal switches in the unit give the integrated avionics units logic for three different flap positions:

- 0 to 8°
- 8 to 20°
- 20 to 40°

CONTROLS AND INDICATIONS

Figure 5

The AOA indication is shown below the airspeed indication on the PFDs. Three display modes are available and accessed via the softkeys inside the PFD Settings menu:

- AOA ON—Displays the AOA indicator on the PFD
- AOA OFF—Removes the AOA indicator from the PFD
- AOA AUTO—Displays the AOA indicator on the PFD display automatically when the AOA meets or exceeds 0.5°

AOA On

Fig. 5: AOA Indications

SYSTEM OPERATION

Figure 6 and Figure 7

As aircraft angle-of-attack (AOA) changes, the AOA vanes move, causing the angle-of-attack transmitter to send a signal to the integrated avionics units. The computer receives inputs from the angle-of-attack transmitter and the air data computers (ADC). The ADCs provide altitude shift information to the integrated avionics unit. The integrated avionics units sums inputs of AOA and altitude shift along with flap position from the flap position indication unit.

The switches provide the integrated avionics unit with logic for three (3) different flap positions:

- 0 to 8°
- 8 to 20°
- 20 to 40°

As the angle-of-attack increases, the stick shaker produces a pulsating force that is transmitted to the control columns. As the shakers actuate, the aural voice warning “Stall” will be repeated through the cockpit speakers and headphones.

As the airplane approaches the angle of attack corresponding to a stall for the specific flap configuration, the low-speed awareness cue displays on both PFDs. Each LSA bar will scroll up the airspeed tape on each display and the top of the LSA bar will reach the indicator airspeed at the point of stall warning activation. These LSA cues indicate to the crew of approaching stall warning prior to the warning activation and assist the crew in maintaining adequate stall margin. If the autopilot was engaged, it will automatically disconnect when the stall warning is triggered.

Fig. 6: Stall Warning Indications

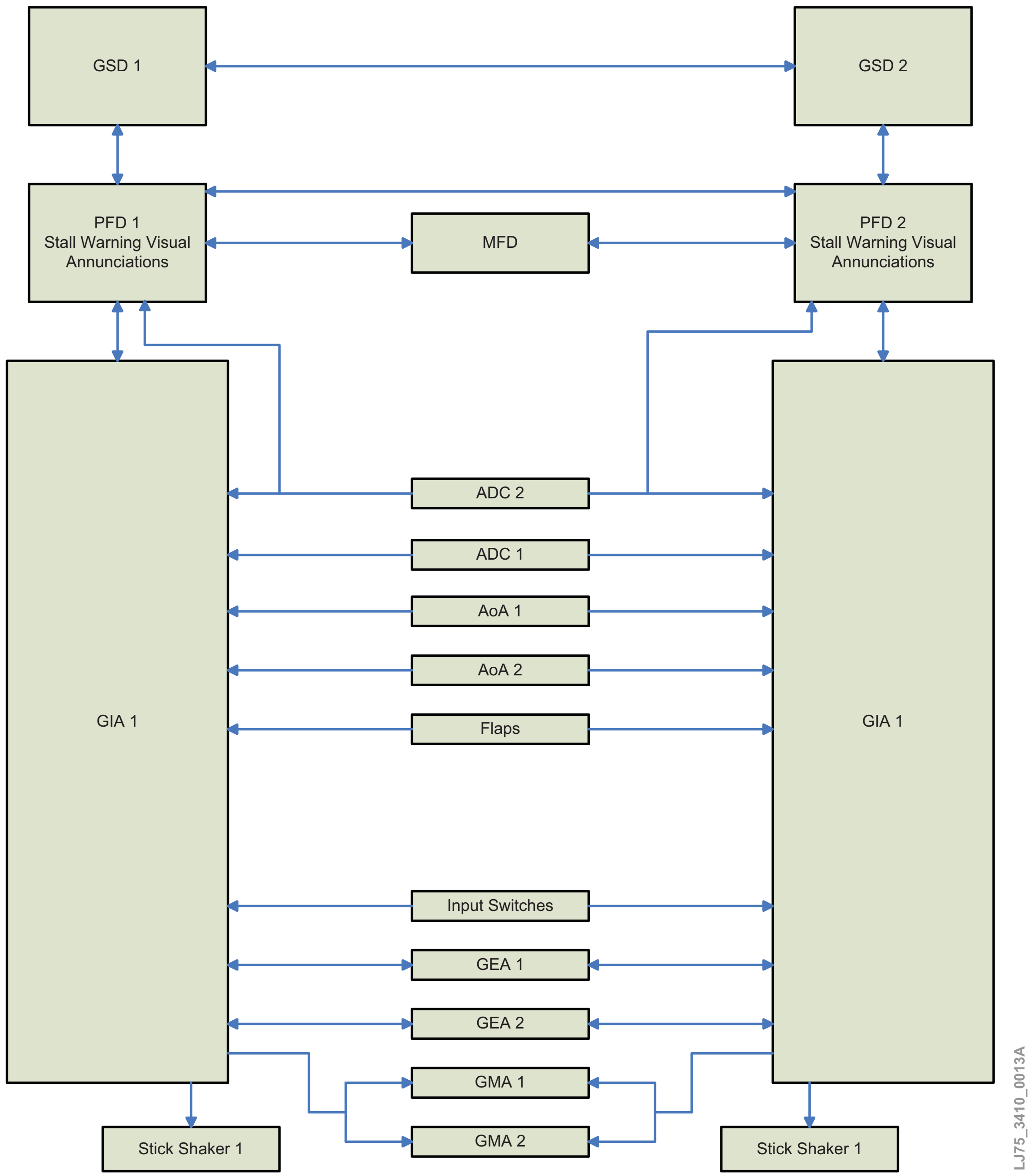


Fig. 7: Stall Warning System and Protection System Block Diagram

System Test

Figure 8

The system test function is controlled by the touch controllers. Weight on wheels must be asserted in order for system test to initiate.

The squat switch input is used to indicate when the airplane is on the ground. This signal and the pilot-activated, self-test signal defeats the control column shaker ground operation inhibits. A 3-second time delay is provided so shaker activation will not occur immediately following the aircraft on-ground condition.

The shaker is active immediately after lift off, but the shaker, low speed awareness cue, aural output, and standby AOA indications are all biased by 2° for 3 seconds to prevent nuisance shaker at lift-off.

Testing stall:

1. From Home screen, touch Aircraft Systems > Systems Selection > System Tests.
2. Touch Stall. Button displays an animated In Progress indication while a test is occurring.

Cancelling an individual system test in progress:

1. On the System Tests screen, touch the button of the test indicating In Progress.

Activation of the stall warning system test causes the following to occur on the pilot and then the copilot side:

- Activation of the Master CAUT tone and switchlights
- Left AOA needle sweeps from 0 (non-stall) to 1 (stall), turning red at the tick mark value, then returning to the previous value at the conclusion of the sweep
- Momentary activation of the left shaker when AOA is in the stall region
- Activation of the “Stall” aural warning

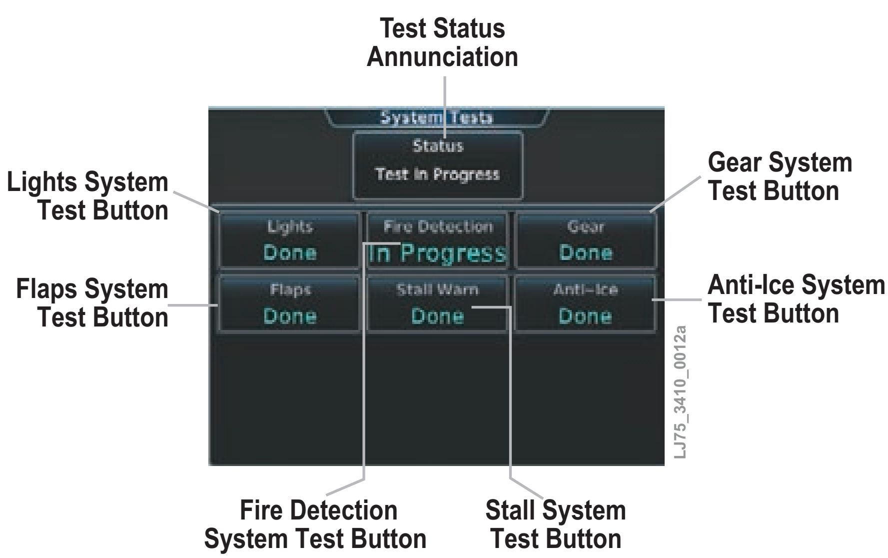


Fig. 8: Aircraft System Tests Screen

FAULT INDICATION

Fault detection within any of the following monitors will cause the stall warning fail output to be asserted:

- Vane heater
- AOA synchro continuity
- AOA synchro reference
- Air data computer
- Shaker output
- Stall vane heater fail
- Internal execution
- Squat switch reasonable is when the squat switch is continuously compared to the airspeed signal, and flap position signal when airspeed exceeds 100 kt with flaps at 0°, it is possible for the weight-on-wheels condition to be true.

The dual stall warning system monitors itself for valid operation, along with reasonableness for all input signals, including:

- Computation
- Loss of power
- Valid (present/within range) angle of attack transmitter signal
- Transducer heating element valid, along with reasonableness for all input signals

Table 1: Stall Warning System – CAS Messages

EICAS MESSAGE	LOGIC
L/R STALL WARN FAIL	Posted when any of the following conditions occur on GIA no. 1 and/or GIA no. 2 In all four instances below, the Invalid parameter message indicates that the parameter of interest failed to meet at least one of the following criteria: 1) the parameter must be within range, 2) the parameter data must be determined to not be corrupt, 3) the parameter must not be missing. • Invalid left AOA • Invalid left flap position indication signal • Invalid left barometric altitude • Invalid left IAS

AOA INDICATOR AMBER X

Figure 9

Overlaid on the left or right AOA indicator. Amber X overlays the AOA indicator when the signal from the AOA transmitter is an invalid value.

Fig. 9: AOA Indicator Amber X

PITOT-STATIC SYSTEM

(ATA 34-11-00)

OVERVIEW

The pitot-static system includes two subsystems: the primary and standby pitot-static systems.

The pitot-static system provides pressure information (pitot and static pressure) directly to standby instruments and to the air data computers to support the flight crew instruments.

COMPONENTS

The pitot-static system consists of the following:

- Pitot-static probes (3)
- Drain valves (2)

COMPONENT DESCRIPTION AND OPERATION

Figures 10, 11, and 12

Pitot-Static Probes

Two pitot-static probes are located on each side of the nose section, forward of FS162 between stringers 12 and 13. The standby pitot-static probe is located forward of FS162 between stringers 8 and 9, R/H.

The pitot-static probes contain the pressure-sensing ports and tubing that supplies pitot and static pressures to the air data computers and standby instruments. Each probe consists of a strut, projecting the probe several inches away from the fuselage to isolate it from pressure disturbances close to the fuselage. The baseplate contains electrical and pressure fittings.

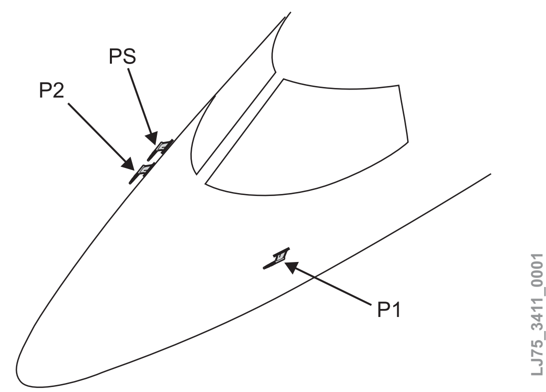


Fig. 10: Pitot-Static Probes Location

Pitot pressure is sensed at an opening in the forward end of the probe and two independent sets of static pressure holes. These holes are located in the contoured midsection of the probe. Electrical heating elements prevent ice accumulation. Each probe produces a pitot pressure output designated P, and two static pressure outputs designated S1 and S2.

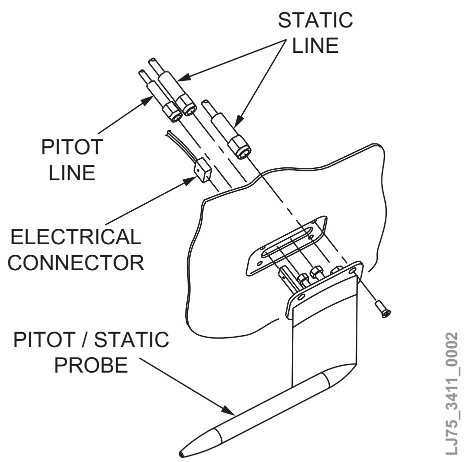


Fig. 11: Pitot-Static Probe

Drain Valves

The drain valves for the standby pitot-static system are located forward of FS162 on the right side. The forward drain valve is the pitot drain, and the aft is the static drain.

The valves drain accumulated moisture and are opened by depressing the bottom center of the drain and rotating counterclockwise with a screwdriver. The valves are spring-loaded to the closed position and are sealed with an internal O-ring.

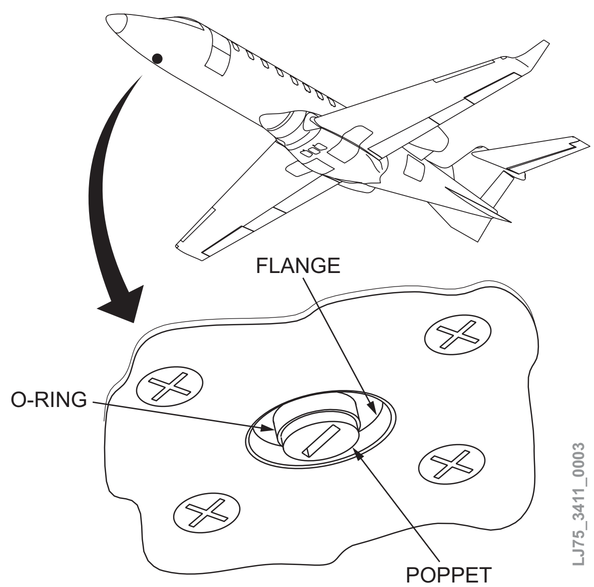


Fig. 12: Drain Valve

SYSTEM OPERATION

Primary Pitot-Static System

Figure 14

Two pitot-static probes, one on each side of the nose section, provide primary pitot and static pressure for ADC 1 and ADC 2.

The pitot sources of the primary pitot/static system are independent. The left probe head provides pitot pressure for the ADC 1, and the right probe head provides pitot pressure for ADC 2.

The pilot and copilot static ports are cross-coupled such that each ADC is connected to static ports on both sides of the aircraft to minimize errors due to sideslip.

Standby Pitot-Static System

The standby pitot-static system consists of a pitot-static probe above the right side probe of the primary system, two drain valves, and an interconnected plumbing network.

The standby pitot-static system uses pure pitot pressure from the tip of the probe and static pressure from the forward static port and aft static port of the probe to drive the ESIS.

The standby system is independent from the primary system and provides a no-pilot action reference to the primary system.

Pitot Heat

Figure 13

All pitot-static probes contain a heater element for protection against icing. The left and right primary pitot-static probe heating elements are controlled by the L PROBES and R PROBES pitot heat switches located on the anti-icing panel of the center pedestal and monitored by the heater monitors.

The standby pitot-static probe heating element is controlled by the R PROBES pitot heat switch located on the anti-icing panel, in the same manner as the primary probes and is also monitored by the heater monitors (refer to Pitot- Static System Anti-ice ATA 30-30-00 for details).

Fig. 13: Probe Heater Switches

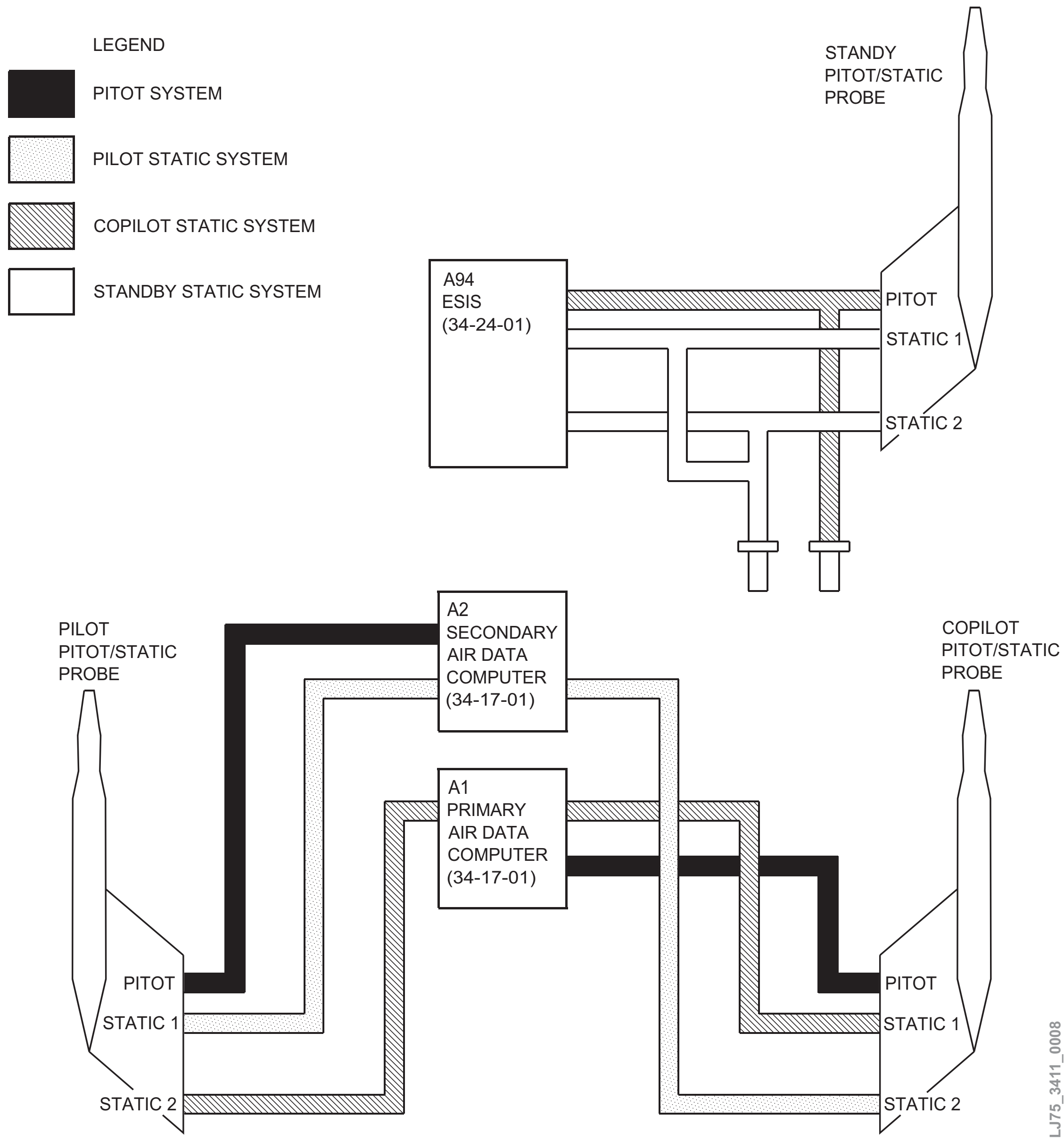


Fig. 14: Pitot-Static System Schematic

RADIO ALTIMETER SYSTEM

(ATA 34-14-00)

OVERVIEW

The radio altimeter system is primarily used during the approach phase of flight to supply a precise indication of aircraft altitude above ground terrain. Information generated by the radio altimeter system is displayed on the primary flight displays (PFDs).

The radio altimeter system consists of a transceiver and dual antennas.

COMPONENTS

Figure 15

The radio altimeter system includes the following:

- Radio altimeter transceiver
- Radio altimeter antennas (2)

ASSOCIATED COMPONENTS

- Remote controllers (2)

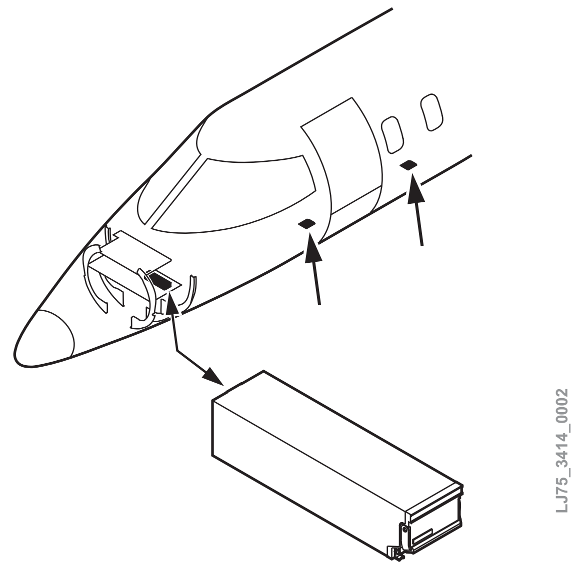


Fig. 15: Radio Altimeter Transceiver and Antennas

COMPONENT DESCRIPTION AND OPERATION

Radio Altimeter Transceiver

The radio altimeter transceiver is installed in the LH aft nose avionics compartment. The radio altimeter transceiver transmits a reference signal to the ground through an antenna, receives the reflected signal through the second antenna.

The radio altimeter transceiver compares the two signals from the antennas to determine the aircraft altitude (up to 2500 ft). This information is then transferred to the data concentrator to be displayed on the PFDs.

Radio Altimeter Antennas

The radio altimeter antennas are installed on the bottom of the aircraft. The forward antenna transmits and the aft antenna receives signals.

SYSTEM OPERATION CONTROLS AND INDICATIONS

Figures 16 and 17

The radio altimeter system is controlled by the touch controller (GTC). The decision altitude (DA) value can be set on the GTC by selecting:

- Utilities from the HOME screen
- Minimums
- Radio altimeter

RA MIN is displayed in cyan with white lettering on the PFDs.

The radio altitude data is displayed on the PFDs in the bottom center of the attitude sphere surrounded by a white box.

Displays:

- RAD ALT height above ground:
  - Display range is -20 to +2500 ft when radio altitude is less than 2500 ft
  - Display shall be blank when radio altitude is greater than 2550 ft
  - Display resolution is 5 ft from -20 to 200 ft and 10 ft if altitude is greater than 200 ft
- Ground line graphical indication on the altitude tape
- RA FAIL if RAD ALT data becomes invalid
- TCAS FAIL and TAWS FAIL if RAD ALT data becomes invalid

Low altitude awareness is supplied for display on the altitude tape. When radio altitude is less than 550 ft, the lower portion of the altitude tape will start to change color to brown. A horizontal line will be drawn across the altitude tape at the transition point. The shaded portion of the tape will rise for radio altitude between 0 and 550 ft. At 0 ft, the entire lower portion of the altitude tape will be brown.

The radio altimeter interfaces with TAWS, landing gear position and warning system and TCASII systems for radio altimeter input.

As a backup function, the remote controllers can be used to control RA minimums settings. The PROC button can be used to set up an approach procedure, and RA minimums can be set accordingly.

Fig. 16: Display

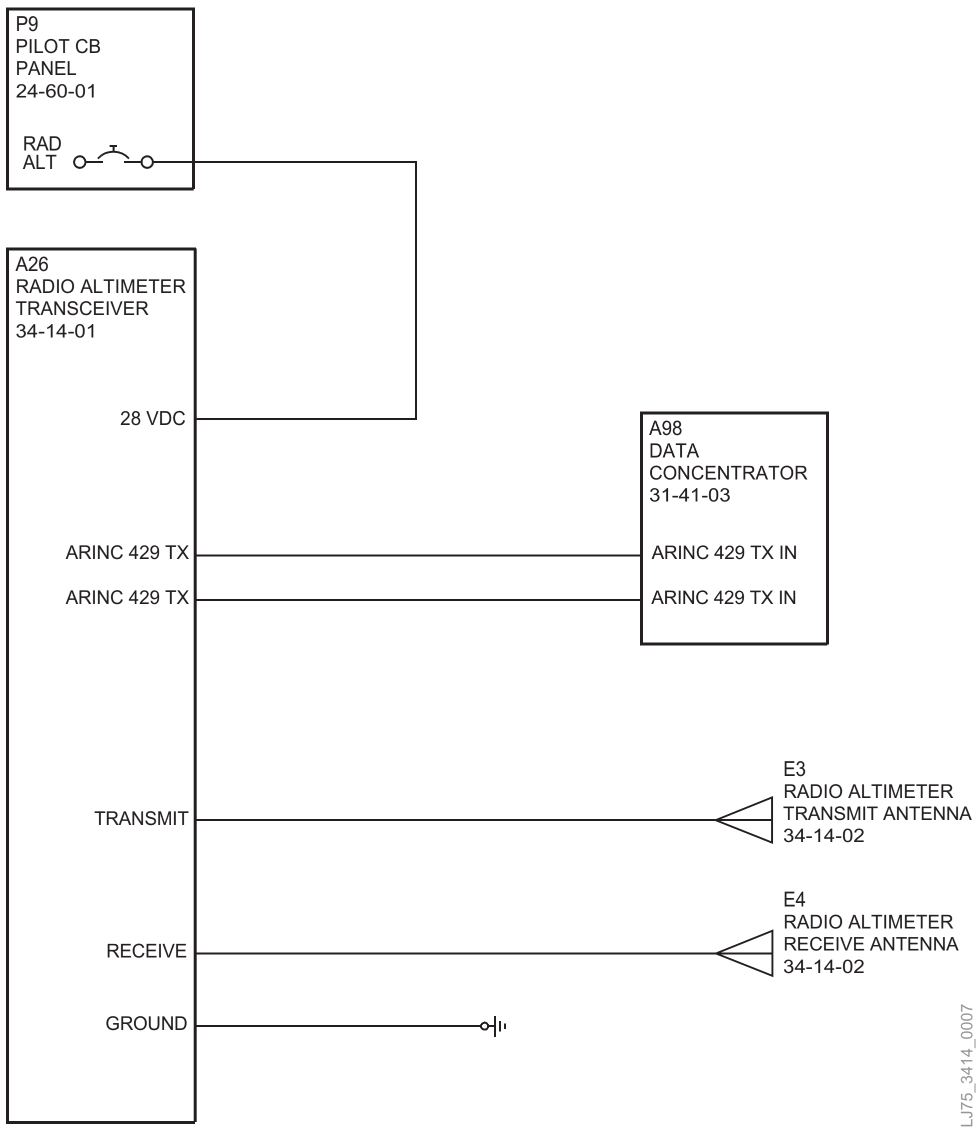
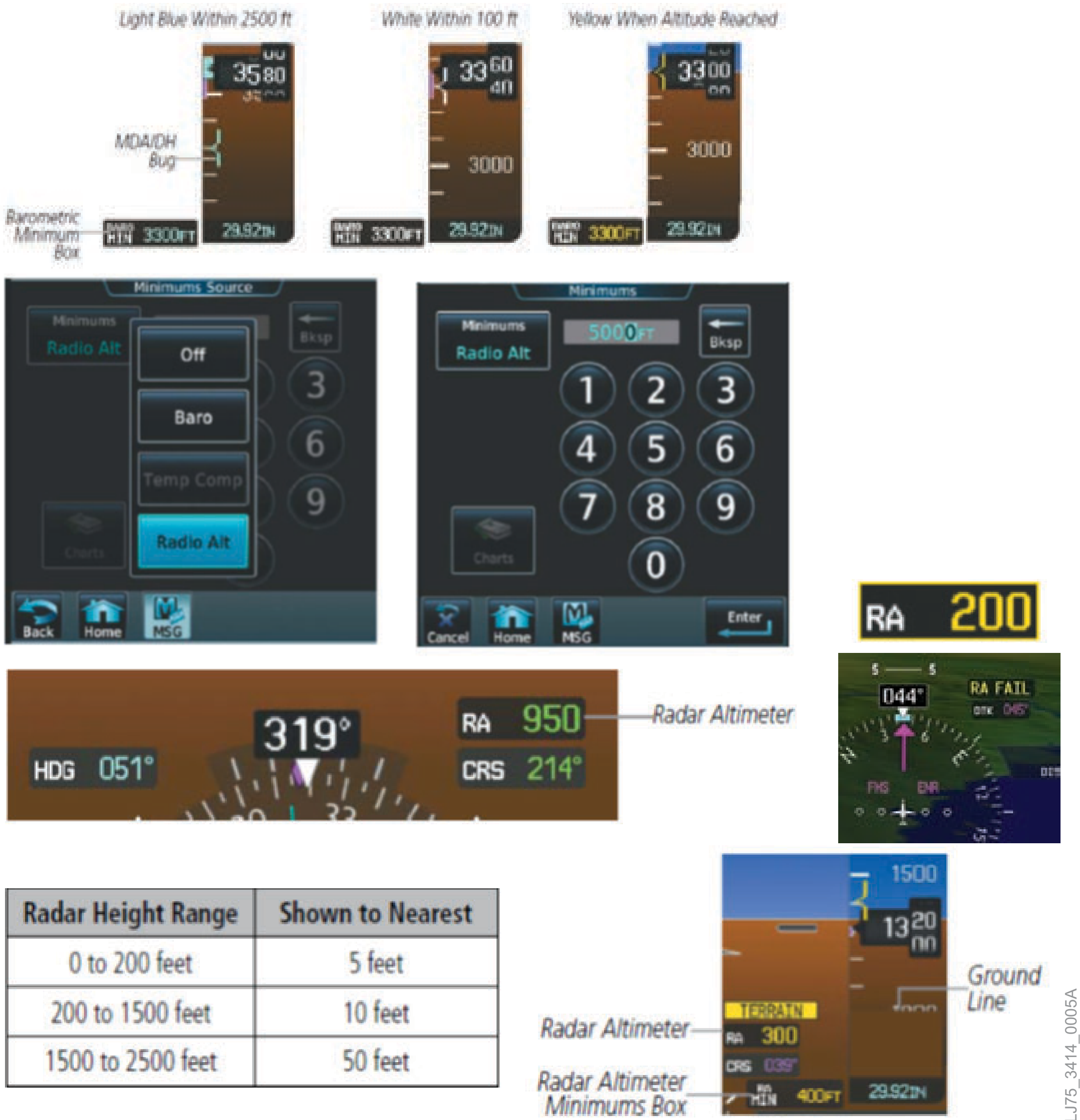


Fig. 17: Radio Altimeter System Electrical Control Block Diagram

Fault Indication

Figure 18

If the radar altimeter data becomes invalid, a yellow RA FAIL message is displayed in place of the current radar height on the PFDs.



Radar Height Range	Shown to Nearest
0 to 200 feet	5 feet
200 to 1500 feet	10 feet
1500 to 2500 feet	50 feet

Fig. 18: RAD ALT Images

Minimum Descent Altitude/Decision Height Alerting

For altitude awareness, a minimum descent altitude (MDA) or decision height (DH), based on barometric or radar altitude, can be set. When active, the altitude setting is displayed to the lower left of the altimeter and with a bug at the corresponding altitude along the altimeter (once the altitude is within the visible range of the tape). The following visual annunciations alert the pilot when the aircraft is approaching the MDA/DH:

- When the aircraft altitude descends to within 2500 ft of the MDA/DH setting, the BARO MIN or RA MIN box appears with the altitude in light blue text; the bug appears on the altitude tape in light blue once in range
- When the aircraft passes through 100 ft of the MDA/DH, the bug turns white
- Once the aircraft reaches the MDA/DH, the bug and text turn yellow and the "Minimums Minimums" aural alert sounds

Alerting is inhibited while the aircraft is on the ground and until the aircraft reaches 150 ft above the setting for the alert. If the aircraft proceeds to climb after having reached the MDA/DH, once it reaches 50 ft above the MDA/DH, alerting is disabled.

The MDA/DH may be set from either PFD and is synchronized on both PFDs. The function is reset (set to Off when the power is cycled or another approach is activated.

Setting the Baro/Radio Alt Minimum Descent Altitude/Decision Height and bug:

1. From the Home screen, touch Utilities > Minimums > Minimums.
2. Touch Baro, Temp Comp, or Radio Alt (OFF is selected by default).
3. Use the keypad to enter the desired altitude from zero to 16,000 ft, and touch Enter.

When the radar altimeter is selected as the altitude source for the minimum descent altitude/decision height alerting function, the radar altimeter numeric display changes to yellow upon descent to or below this altitude. Refer to the Minimum Descent Altitude/Decision Height Alerting discussion in this section for more information about this function.

SYSTEM INTERFACES

Power

The radio altimeter receives power from a 2 amp circuit breaker tied to the left essential 28 VDC bus located on the pilot circuit breaker panel.

AIR DATA SYSTEM

(ATA 34-17-00)

OVERVIEW

The air data system provides aircraft airspeed, air temperature and altitude data for the primary flight displays, attitude and heading reference system, stall warning system, autopilot, transponders, spoileron computer, cabin pressurization, digital electronic engine control (DEEC), landing gear warning system, and flight management system.

The air data system receives aircraft static and impact pressure information from pitot-static pressure probes and raw air temperature from an outside temperature probe. With the raw data from the appropriate sensors, the air data computer (ADC) processes data from the pitot-static system and total air temperature (TAT) probe.

COMPONENTS

Figure 19

The air data system consists of:

- Air data computers (ADCs) (2)
- Dual element temperature probe (TAT)

ASSOCIATED COMPONENTS

- Remote controllers (2)
- Display units (3)
- Touch controllers (2)
- Primary pitot static probes (2)

COMPONENT DESCRIPTION

Air Data Computers

Figure 19

ADCs 1 and 2 are located forward of the instrument panel.

The ADC provides air data for flight instrumentation. The system measures aircraft static and impact pressure information from pressure transducers and raw air temperature from an outside temperature probe. Using the raw data from the appropriate sensors, the unit computes pressure altitude, vertical speed, airspeed values, air temperature information and density altitude. Aircraft specific configuration parameters are stored internally.

The system provides pitot-static and temperature-derived air data to the GIA integrated avionics unit, GRS attitude heading and reference sensor, and the GDU primary flight displays.

The ADCs provide the following information in ARINC 429 format:

- Air temperature (total air temperature, outside/static air temperature)
- Corrected static pressure
- Density altitude
- Impact pressure uncorrected
- Indicated airspeed
- Mach number
- Pressure altitude
- Total pressure
- True airspeed
- Vertical speed

In addition to providing the functions listed above, the ADCs are reduced vertical separation minimums (RVSM) capable. The ADCs software implements airframe-specific static source error correction (SSEC) equations that correct for changes in the measured air pressure. These changes in pressure are due to disturbances created by the aircraft in flight. Additionally, the ADC supports installation-specific external sensor data such as angle of attack.

TAT Probe

The total air temperature probe is mounted on the right side of the aircraft located at FS138. The TAT probe is a dual-element temperature probe that transmits total air temperature to the ADCs. The ADCs calculate the static air temperature from the temperature sensor input as a function of altitude and airspeed.

The TAT probe heater is controlled by the R PROBES pitot heat switch located on the pilot anti-icing panel and monitored by the heater monitors. The heating elements are off when the aircraft is on ground (refer to ATA 30-30-00 for details).

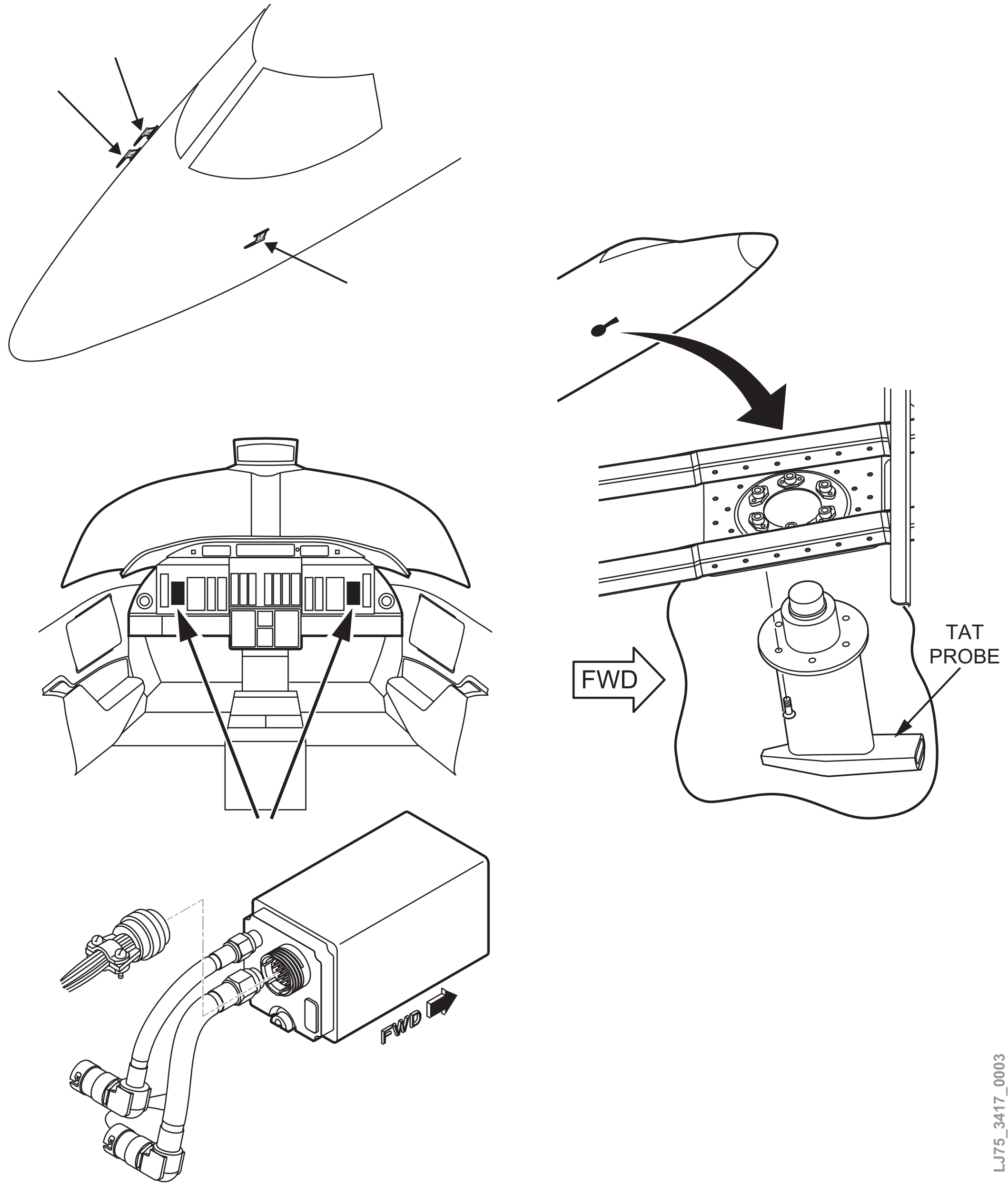


Fig. 19: Air Data Computer

SYSTEM OPERATION

Figure 20

The air data system provides aircraft airspeed, air temperature, and altitude data for the EFIS displays, attitude and heading reference system, stall warning system, autopilot, transponders, spoileron computer, cabin pressurization, digital electronic engine controller (DEEC), landing gear warning system, and flight management system.

The system accepts static air pressure, total air pressure, total air temperature, several discrete signals, and barometric set inputs. The system performs the necessary computations and outputs the following air data values:

- Barometric altitude
- Pressure altitude
- Indicated airspeed (IAS)
- Mach number
- Vertical speed (VS)
- Maximum operating speed (V_{MO})
- Static and total air temperature (SAT and TAT)
- True airspeed (TAS)

CONTROLS

Selection of the air data source is controlled via display softkeys on the DUs in reversionary and normal mode.

Barometric pressure correction can be enabled or reset to a reference value for each ADC using the push button labelled STD on the associated remote controller. With baro correction reset, the reference pressure is set to 29.92 InHg (1013.24 hPa). With correction enable the range provided is 22.0 InHg to 32.0 InHg (724 hPa to 1083 hPa).

With baro correction enabled, each ADC will receive the selected baro correction through a rotary knob labeled BARO on the associated remote controller. Rotating this control clockwise will increment the baro reference pressure, and rotating the control counterclockwise will decrement the baro reference pressure. The baro reference pressure is displayed on each DU.

The baro correction reference value on each DU can be displayed in either InHg or hPa via DU PFD Settings softkey

INDICATIONS

Air data is displayed on the EFIS system as follows: vertical speed is shown on the vertical speed tape; temperature is shown on the OAT, ISA, and SAT windows; airspeed and Mach number are shown on the airspeed tape; altitude is shown on the altitude tape; barometric correction is shown on the BARO Setting window; and airspeed is shown on the TAS window.

AIRCRAFT INTERFACES

Figure 20

Primary ADC 1 is provided via ARINC 429 to DU1, DU2.

Primary ADC 2 is provided via ARINC 429 to DU3.

Secondary ADC is provided via ARINC 429 to respective onside integrated avionics units that are converted to HSDB.

Additional RS-232 interfaces provide code loads and product status to the integrated avionics units.

The ADCs provide pneumatic connections for pitot and static pressure from the pitot-static probes.

The ADCs obtain air temperature data from the air temperature probe compensating for wiring resistance, Mach recovery factor, and probe self-heating errors.

The ADCs obtain static air pressure and pitot pressure from the pitot-static probes.

Each ADC provides one RS-232 bus interface to the avionics test connectors for ground testing and analysis. The test connectors are mounted in the center pedestal.

Each ADC accepts the following input discretes:

- VMO/MMO Alt (Mach Trim Fail)—Allows for the selection of the normal or alternate curves for generating VMO/MMO. If mach trim fails, the alternate MMO curve is selected
- Unit Identification—Specifies aircraft type and configuration during all modes of operation
- Weight on Wheels—Used to determine mode of ADC operation
- Static Source Error Correction Disable—Permanently enabled
- Source/Destination Identifier—Defines the position (LH [primary] or RH [secondary]) of the ADC
- TAT Probe Heat—Used to indicate to each ADC when TAT probe anti-icing heat is selected
- Baro STD—Used by STD Switch on associated DU to disable or enable baro correction function
- InHg/hPa—Used by BARO knob to select InHg or hPa for display

Each ADC provides the following output discretes:

- Overspeed Warning—Actuates overspeed warnings when speed trip point is reached
- Gear Warning—Provides output to landing gear control and indication system
- Gear Door Caution—Provides output to gear door caution if doors are open over 200 KTS
- Emergency Lighting Enable—Prevents airborne operation of the emergency lights from the emergency battery (Figure 20)

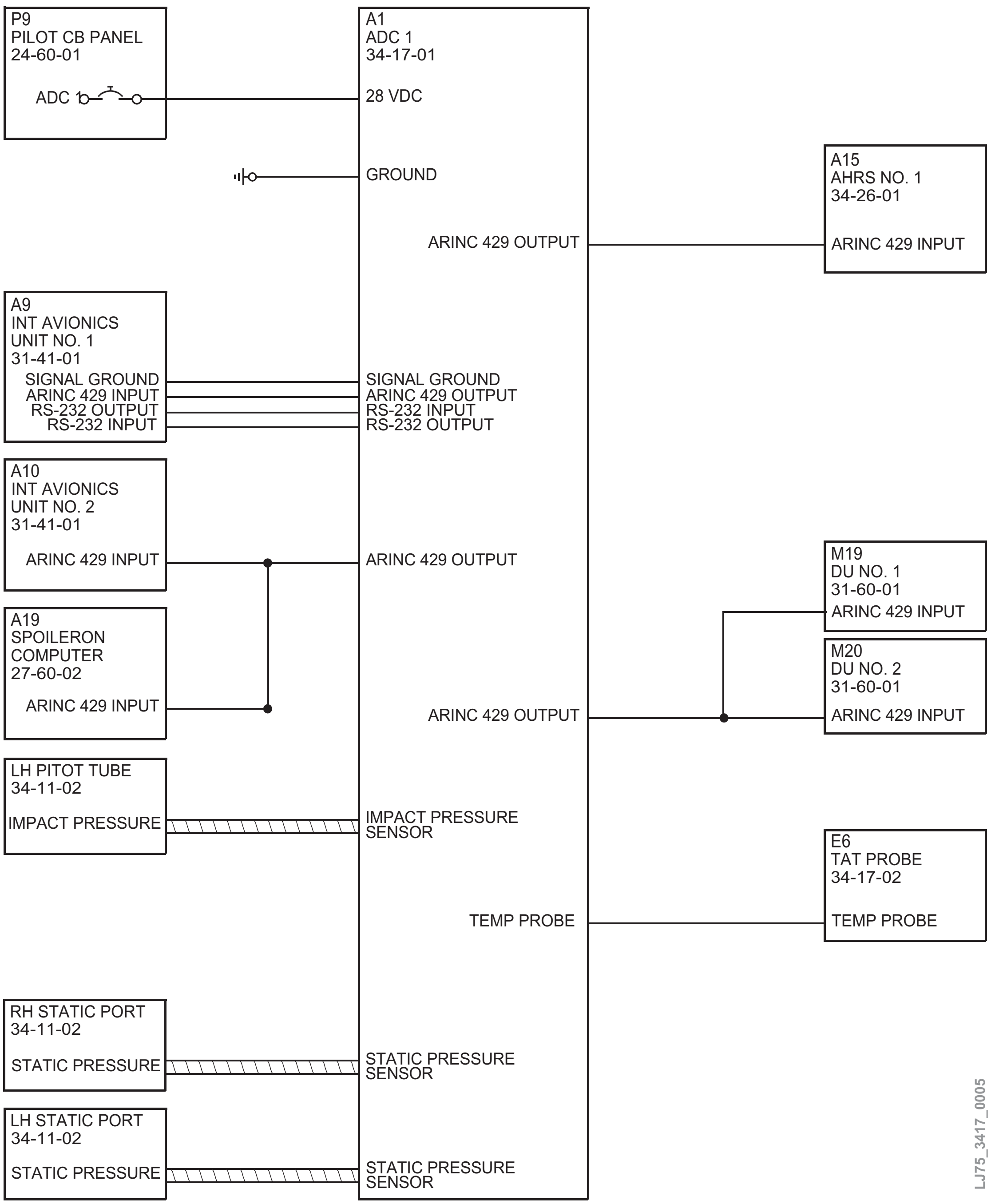


Fig. 20: Air Data System Block Diagram (1 of 2)

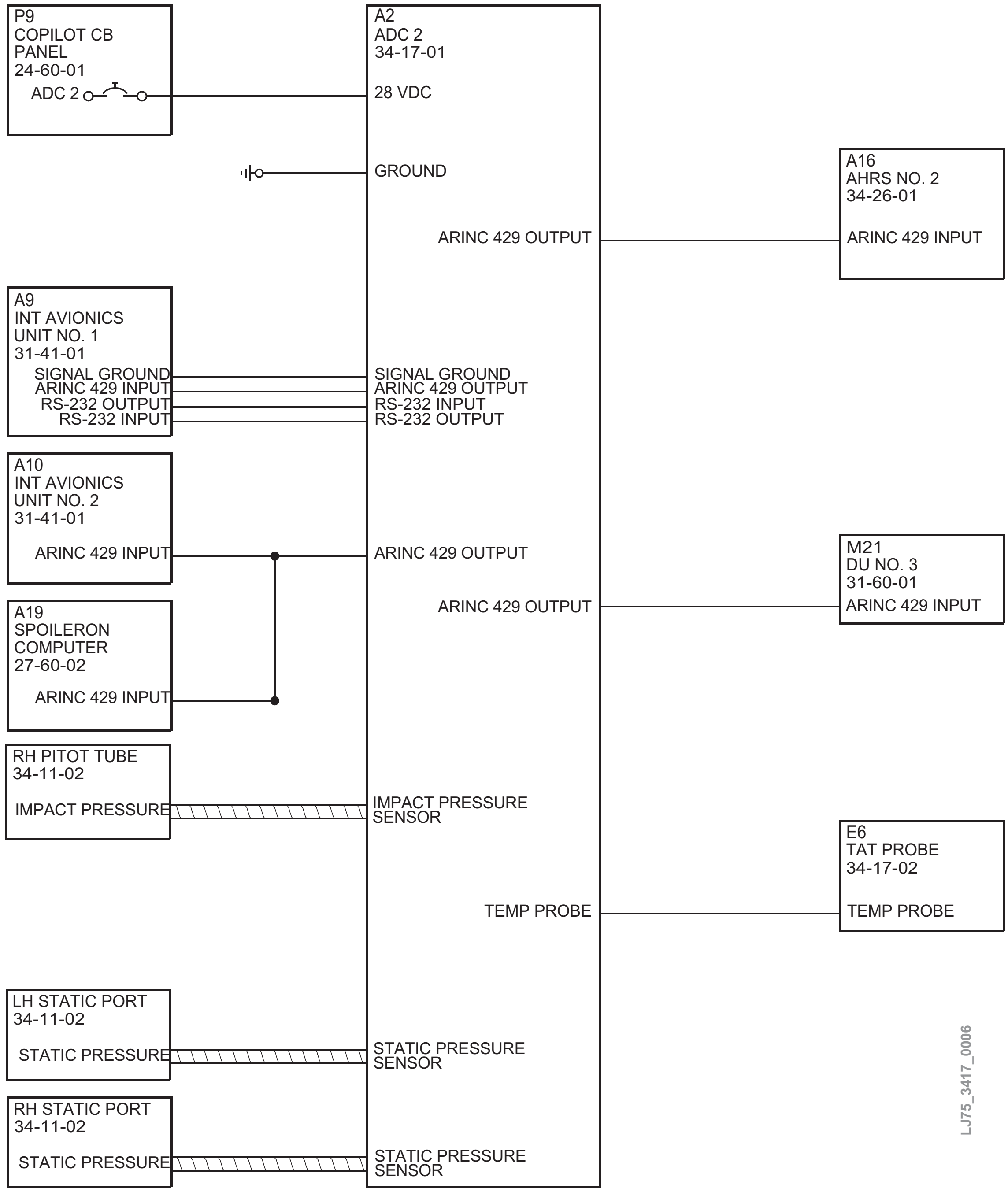


Fig. 20: Air Data System Block Diagram (2 of 2)

COMPARATOR ANNUNCIATIONS

Miscompare Annunciations (PFD)

No Compare Annunciations (PFD)

Annunciation	Description	Condition
ALT	Altitude Miscompare	Difference in altitude sensors is ≥ 200 ft
IAS	Indicated Airspeed Miscompare	If both airspeed sensors detect < 60 kt, this is inhibited
		If either airspeed sensor detects ≥ 60 kt, and the difference in sensors is > 5 kt
HDG	Heading Miscompare	Difference in heading sensors is > 6°
PIT	Pitch Miscompare	Difference in pitch sensors is > 5°
ROL	Roll Miscompare	Difference in roll sensors is > 6°
ALT	Altitude No Compare	No data from one or both altitude sensors
IAS	Indicated Airspeed No Compare	No data from one or both airspeed sensors
HDG	Heading No Compare	No data from one or both heading sensors
PIT	Pitch No Compare	No data from one or both pitch sensors
ROL	Roll No Compare	No data from one or both roll sensors

LJ75_3417_0007

Fig. 21: Comparator Annunciations

FAULT INDICATION

Table 4: Air Data System – CAS Messages

CAS MESSAGE	LOGIC
ADC 1 FAULT	Occurs when ADC 1 altitude or airspeed error correction is unavailable.
ADC 2 FAULT	Occurs when ADC 2 altitude or airspeed error correction is unavailable.
ADC 1-2 FAULT	Occurs when ADC 1 and 2 altitude or airspeed error correction is unavailable.
ADC 1 PATH FAIL	Occurs on the ground with a failure of the primary path between ADC 1 and DU 1.
ADC 2 PATH FAIL	Occurs on the ground with a failure of the primary path between ADC 2 and DU 3.
ADC 1 PATH FAIL	Occurs in air with a failure of the primary path between ADC 1 and DU 1
ADC 2 PATH FAIL	Occurs in air with a failure of the primary path between ADC 2 and DU 3

This page intentionally left blank

ELECTRONIC STANDBY INSTRUMENT SYSTEM (ESIS)

(ATA 34-24-00)

OVERVIEW

The ESIS is an integrated solid state standby system displaying attitude, altitude, airspeed and heading. The attitude data is sourced from internal sensors; heading data is sourced from the standby magnetometer, altitude, airspeed and vertical speed is sourced from the standby pitot-static probe.

COMPONENTS

The electronic standby instrument system consists of:

- ESIS display
- Magnetometer

ASSOCIATED COMPONENTS

- Configuration module

COMPONENT DESCRIPTION

ESIS Display

Figure 22

The ESIS display is located in the center of the instrument panel below display unit 2.

The ESIS display provides aircraft pitch, roll, and slip skid data derived from an internally mounted 3-axis inertial sensor pack.

Magnetometer

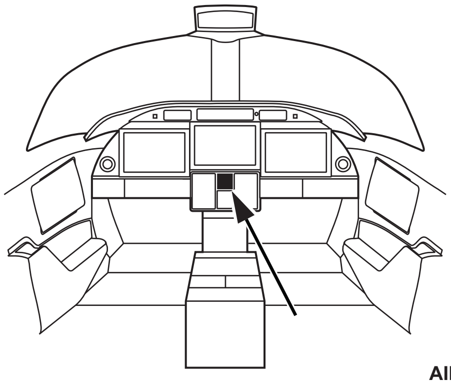
Figure 23

The magnetometer is located on a tray in the stinger. The magnetometer is a remotely mounted device that provides the ESIS display with flight attitude and heading data.

ASSOCIATED COMPONENT DESCRIPTION

Configuration Module

The ESIS includes a detachable configuration module that will contain sufficient non-volatile memory to retain identification codes that describe specific hardware and software configuration of each installation, such as panel angle and navigation interface, static source error correction constants, and display format configuration. When the standby indicator is removed from the aircraft, the configuration device remains in the aircraft attached to the aircraft cable that mates with the indicator, thereby eliminating the need to reprogram a replaced standby indicator LRU.



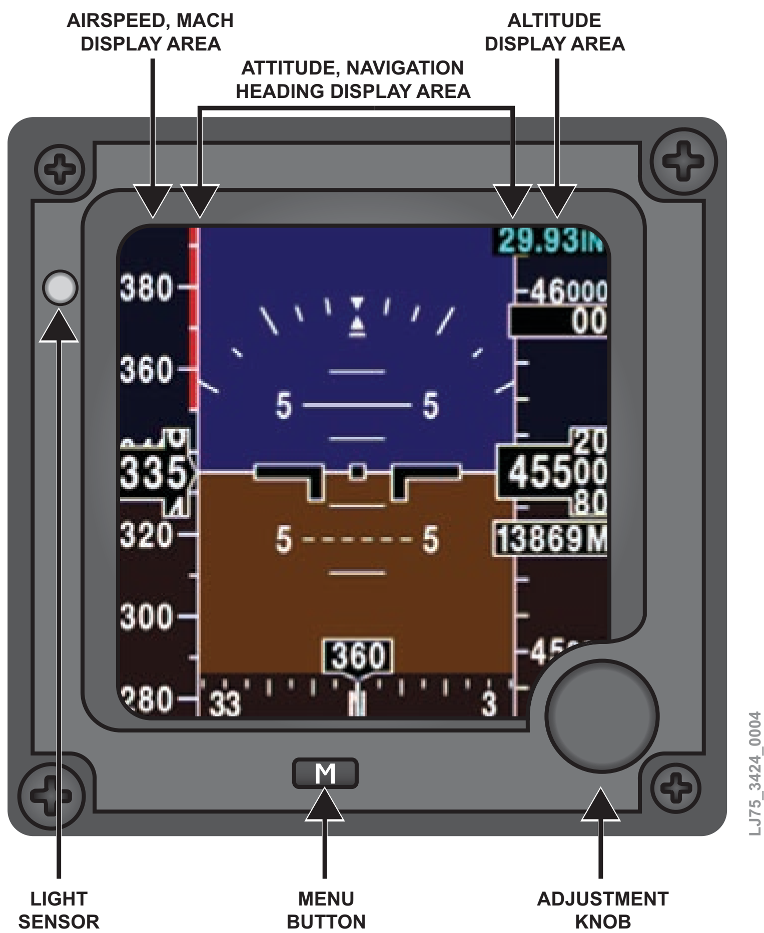


Fig. 22: Electronic Standby Instrument

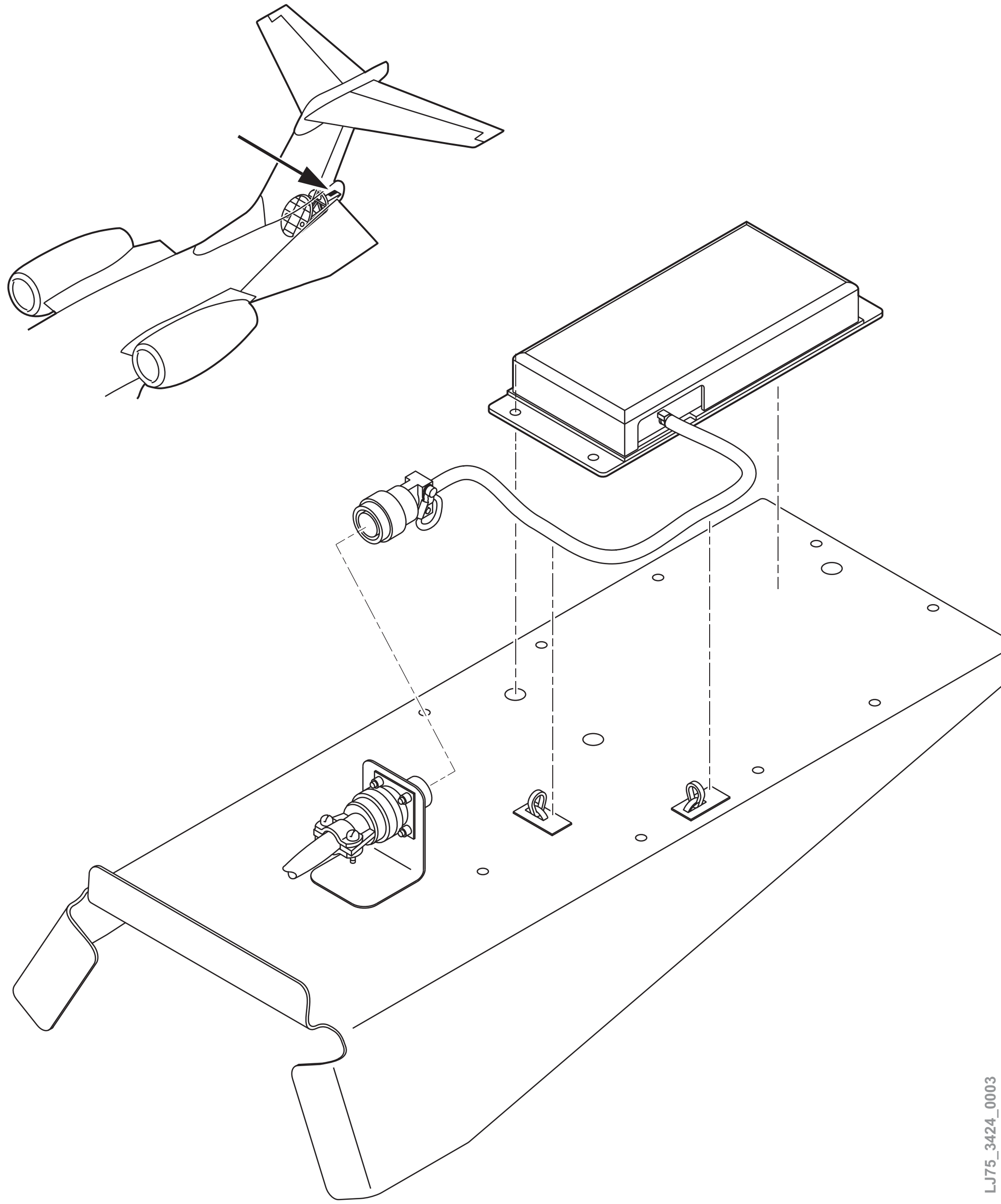


Fig. 23: Magnetometer–ESIS

SYSTEM OPERATION

Figure 24

When powered up, the ESIS cycles through the following sequence:

1. Self test
2. System identification splash screen
3. Sensor alignment
4. Normal operating mode

NOTE

If the unit is powered on in-air, the unit transitions directly to sensor alignment, showing attitude data (blue sky over brown ground).

Self-Test

Application of power begins the unit's diagnostic of sensors, memory, and circuitry. The self-test lasts for approximately 7 seconds. During this time the display remains blank. Once the self-test is complete, the display transitions to the system identification splash screen.

SystemID Splash Screen

The system identification splash screen shows the following information:

- System name and L-3 logo
- Aircraft type
- Software version
- Firmware version

If an error is detected during the initial power-on self-test, the system identification splash screen shows an error message.

Alignment

The ESIS is equipped with internal rate and level sensors. The unit transitions from the system identification splash screen and begins aligning if no system failures are detected. When aligning, an ATT ALIGNING message shows above the aircraft reference symbol and a status bar tracks alignment progress. If on the ground, the display also shows a DO NOT TAXI message.

During alignment, navigational data is removed from the display and a heading invalidity may show in place of heading data at the bottom of the display until alignment is complete. The menu can still be accessed while the unit is aligning.

When the unit is on the ground and stationary, attitude aligns to ±1° of vertical pitch and roll.

When the unit is receiving valid heading data, the unit aligns to the following:

- If on the ground and stationary, the heading aligns to ≤2°
- If in the air, the heading tape and readout align to ≤10° where the flight path heading is maintained within ±10°
- If in the air, the attitude aligns to ≤4° vertical pitch and roll when the flight path heading is maintained within ±10°

Normal Operating Mode

Once aligning is complete, the ESIS transitions to normal operating mode.

Controls

The ESIS display has one push button 'M' and a combined rotary/push knob.

The 'M' button is used to provide the ability for the pilot and maintenance to interface with the menu functions.

The rotary/push knob incorporates a push function for press movement and rotational function for rotational movement. The primary use of the knob is to synchronize and adjust the baro-corrected altitude. The secondary use is to scroll and select menu selections and to adjust menu selections.

The lighting controls for the ESIS display consists of:

- Bezel lighting control is completed via pilots switch panel L INSTR switch
- Backlight lighting control is completed via DU/reversion/dimming panel STBY INSTR switch
- Offset brightness is controlled via 'M' (menu) button on the unit:
  - Push Menu button
  - Rotate bezel knob to scroll to "Set brightness offset"
  - Push bezel knob to initiate a change

Indications

The normal operating screen displays the following:

- Attitude (pitch and roll)
- Heading (tape and digital display)
- Altitude (tape and digital display)
- Barometric setting (digital display)
- Slip/Skid indicator
- Airspeed (tape, digital display, and awareness cues)

SYSTEM INTERFACES

Power

Power is supplied to the ESIS display from the EMER BATT BUS, 28 VDC through the STBY INSTR circuit breaker on the pilot circuit breaker panel.

Signal Interface

Interfaces to external navigation systems will be provided through ARINC 429 input channels supporting VOR, ILS, DME and FMS interfaces. Specific configuration is selected through configuration data stored in the detachable configuration module.

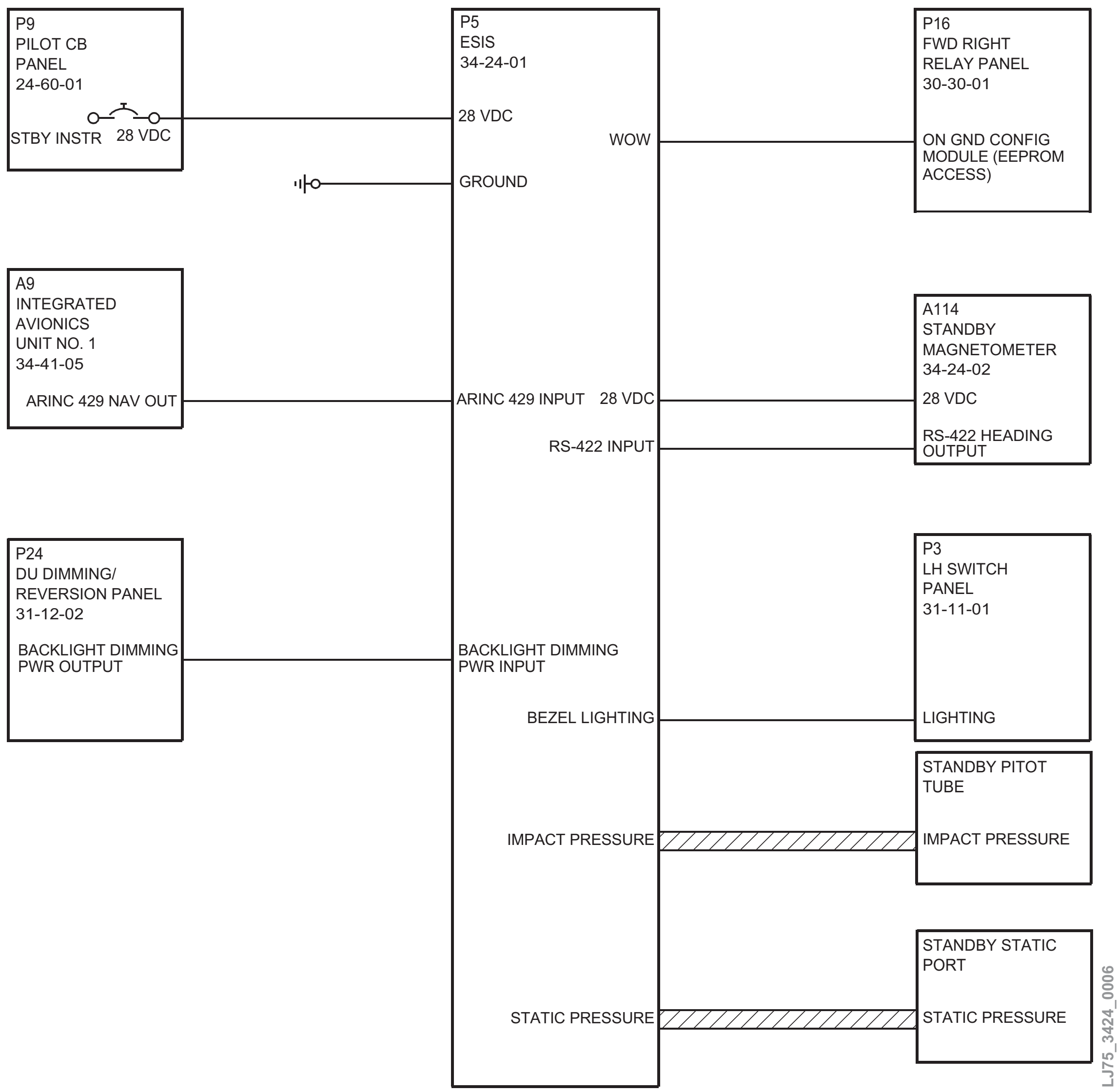


Fig. 24: ESIS Block Diagram

Fault Indication

Failure invalidities show when source sensor data loss is detected.

Fig. 25: ESIS Failure Indications

This page intentionally left blank

ATTITUDE HEADING REFERENCE SYSTEM (AHRS)

(ATA 34-27-00)

OVERVIEW

The attitude heading reference system (AHRS) provides aircraft inertial angular rates and linear accelerations and magnetic heading data to the fuel indicating system and weather radar system.

COMPONENTS

The AHRS consists of the following components:

- Attitude heading and reference units (AHRUs) (2)
- Magnetometers (2)

ASSOCIATED COMPONENTS

- GDUs (3)
- Configuration modules (2)

COMPONENT DESCRIPTION

Figure 26

Attitude Heading Reference Units

The AHRUs are located on the left and right sides of the aircraft aft of FS126, WL4.74 in the nose avionics bay.

The AHRU provides aircraft attitude and heading information via ARINC 429 to both the onside display unit and the onside integrated avionics units.

The AHRU contains accelerometers and rate sensors and interfaces with the onside magnetometer and the air data computers. GPS information is obtained from the integrated avionics units.

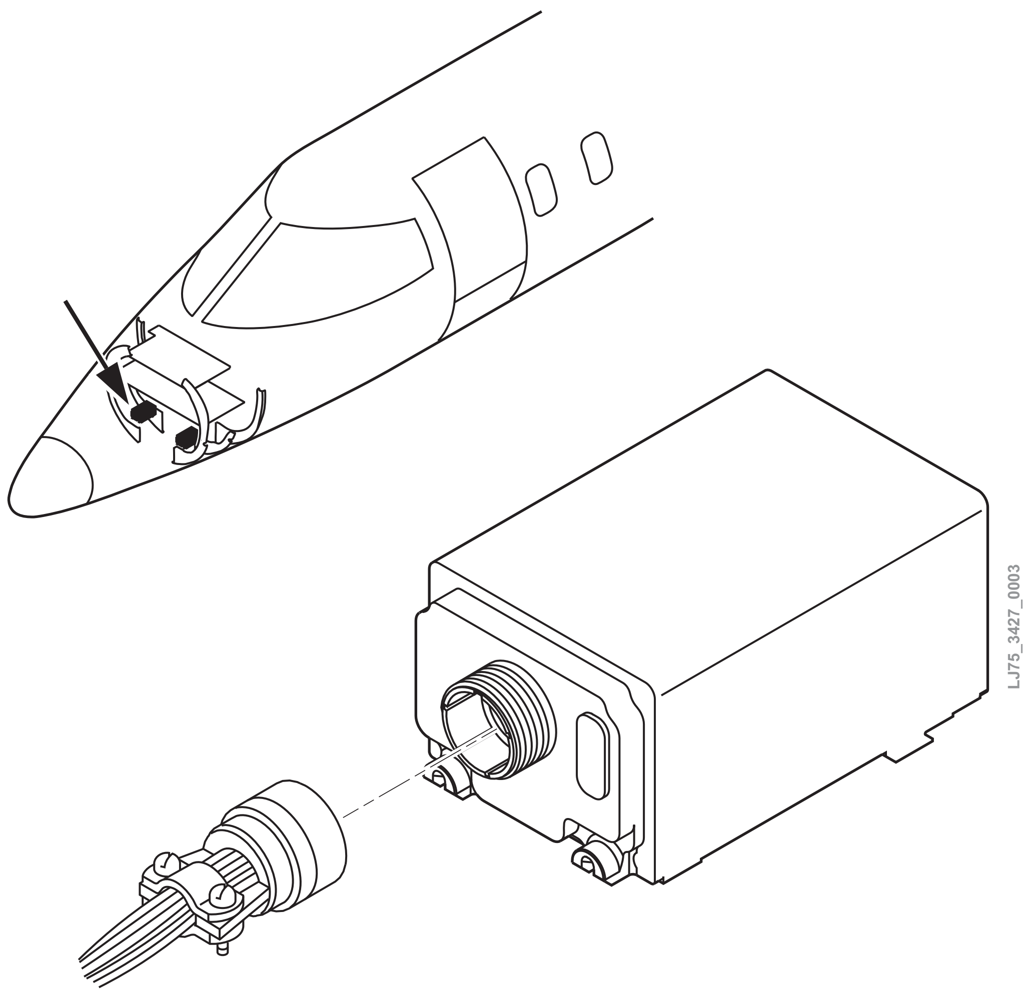


Fig. 26: Attitude Heading Reference System

Magnetometers

Figure 27

The magnetometers measure local magnetic fields. Data is sent to the AHRU to determine aircraft magnetic heading.

The magnetometers are mounted on the left and right outboard wings. The magnetometer receives power directly from the onside AHRU and communicates with the AHRU using an RS-485 digital interface.

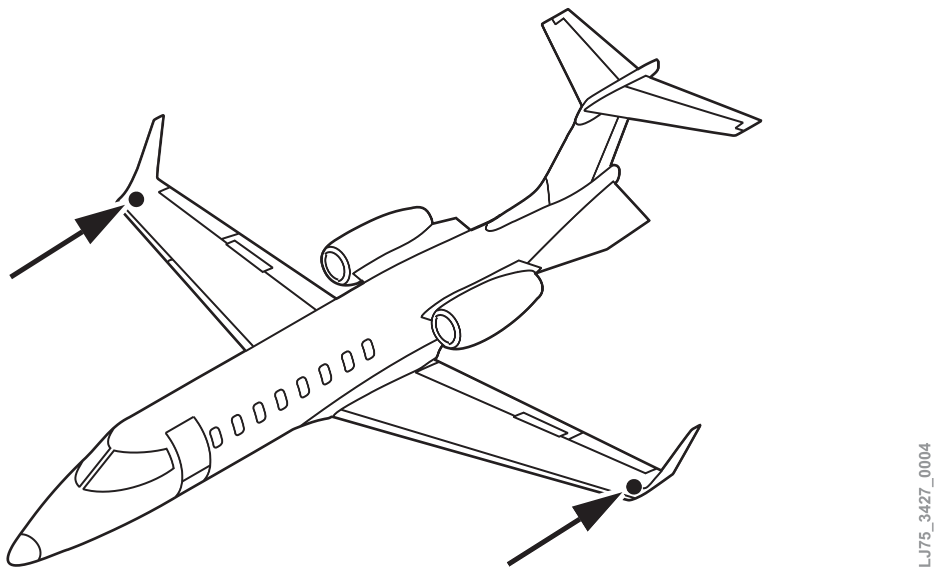


Fig. 27: Magnetometer–AHRS

SYSTEM OPERATION

Figure 28 and 29

Indications

The following data is displayed on DU 1 and DU 3. This information is displayed on DU 2 in reversionary mode:

- Attitude
- Heading
- Altitude
- Airspeed
- Vertical speed
- Outside air temperature

Modes of Operation

Normal

In normal mode all three internal AHRU functions (pitch, roll, heading) are available.

Requirements for normal operation are as follows:

- At least one GPS input from the integrated avionics units
- Magnetic Heading from the magnetometers
- Airspeed
- Outside air temperature
- Pressure altitude and rate of climb from the air data computers

Reversionary

No GPS—No position, velocity, or time available from the GPS.

Reversionary No Magnetometer

No heading information is available from the magnetometer or internally from the AHRU

Reversionary No Magnetometer No Air Data

No heading information is available from the magnetometer or internally from the AHRU. No airspeed, outside air temperature, pressure altitude, and rate of climb from the air data computers.

SYSTEM INTERFACES

Power

Primary power to the no. 1 ARHU is supplied through a circuit breaker on the L ESSENTIAL BUS on the pilot side circuit breaker panel. Secondary power to the no. 1 AHRU is supplied through a circuit breaker on the EMERGENCY BUS copilot circuit breaker panel.

Primary power to the no. 2 ARHU is supplied through a circuit breaker on the R ESSENTIAL BUS on the copilot side circuit breaker panel. Secondary power to the no. 2 AHRU is supplied through a circuit breaker on the L ESSENTIAL BUS on the pilot circuit breaker panel.

The AHRS is controlled through the DUs via softkey selection.

Primary

AHRS 1 is provided via A429 to DU1, DU2.
AHRS 2 is provided via A429 to DU3.

Secondary

AHRS is provided via A429 to respective onside integrated avionics units that are converted to HSDB.

Third Backup

AHRS is provided via A429 to respective cross-side integrated avionics units that are converted to HSDB.

Additional RS-232 Interfaces

Provide code loads and product status to the integrated avionics units.

Magnetometer Interfaces

- RS-232 from AHRU to magnetometer
- RS-485 from magnetometer to AHRU
- Magnetometer power provided by onside AHRU

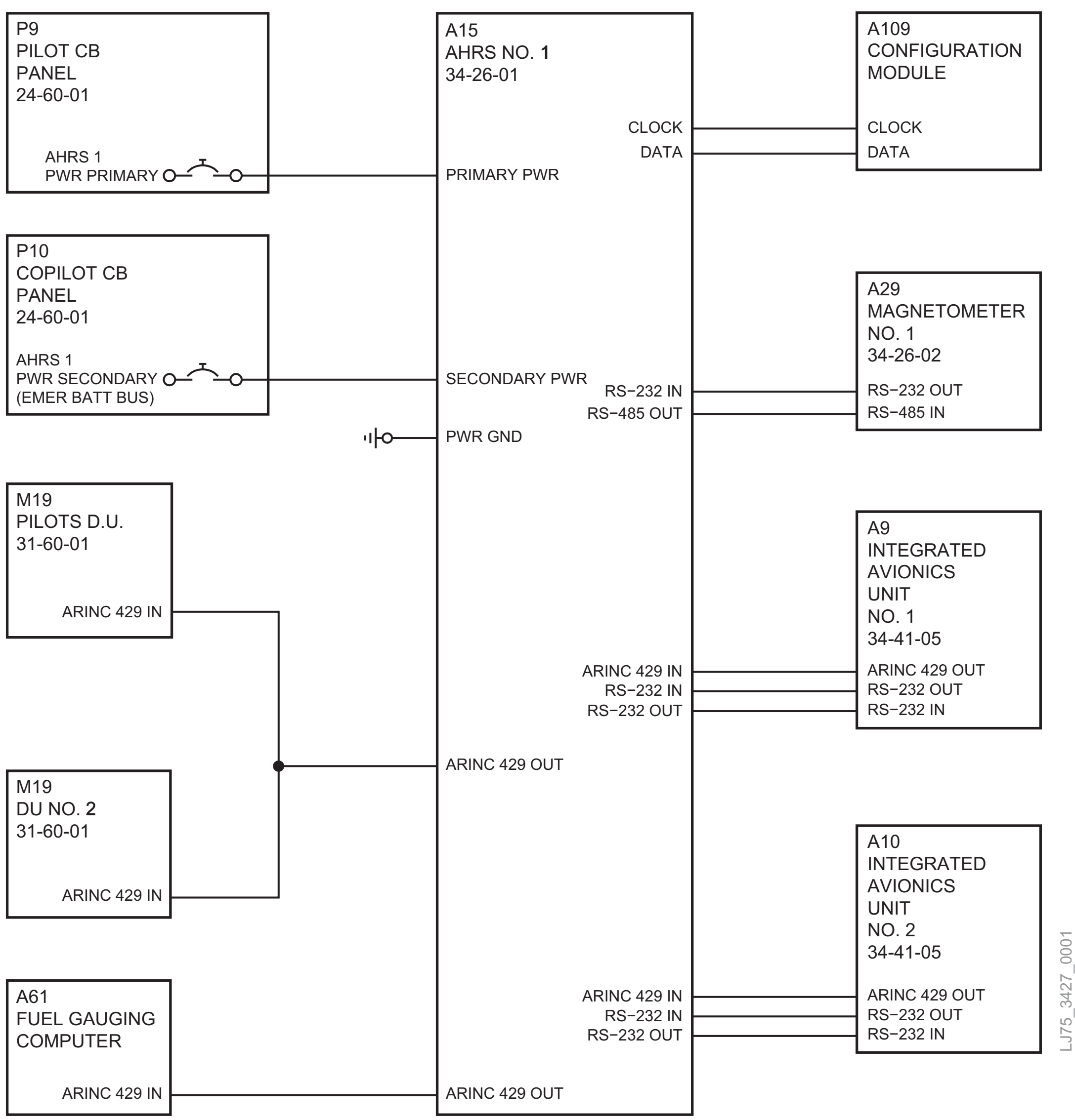


Fig. 28: AHRS Block Diagram (Sheet 1 of 2)

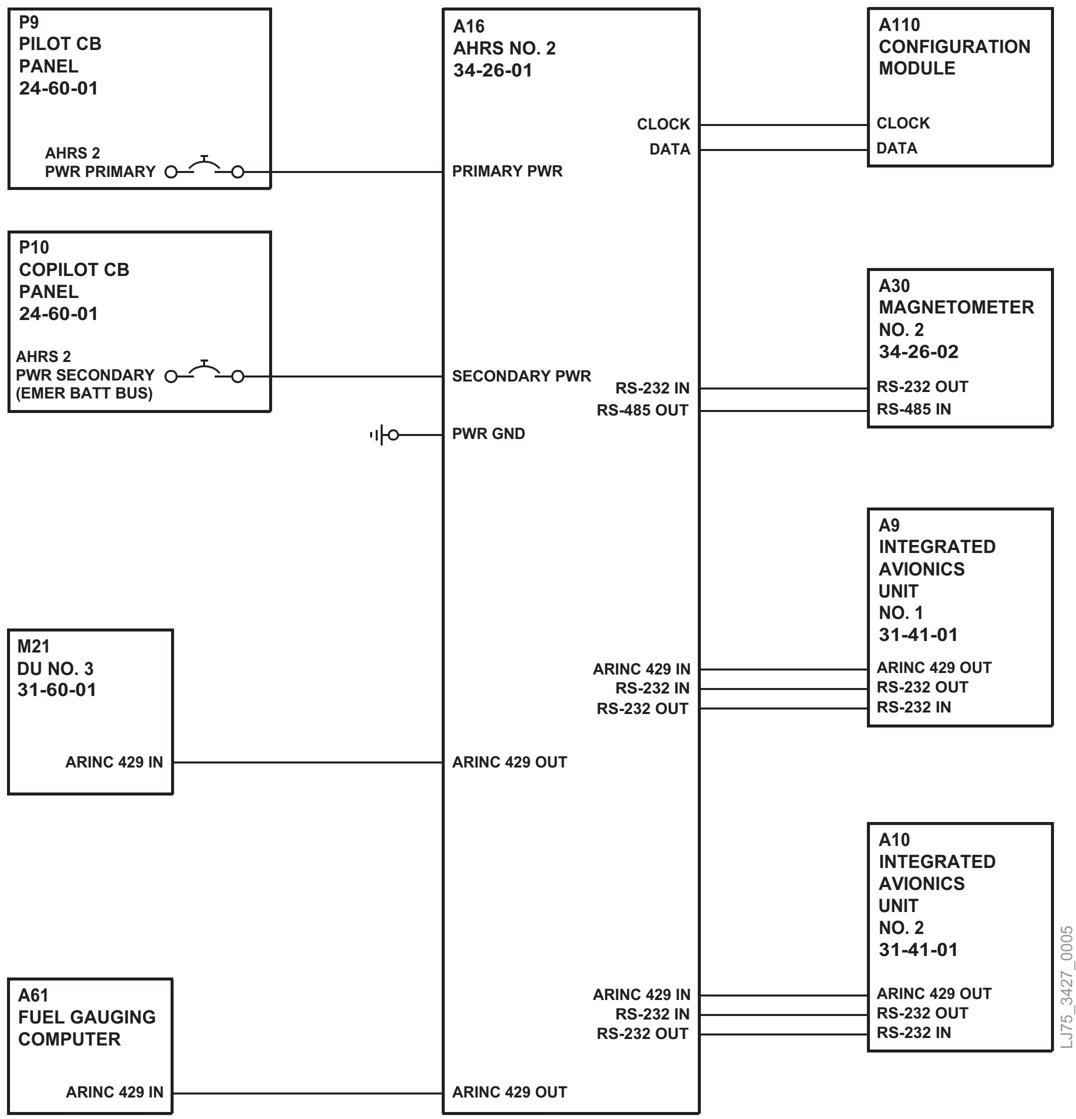


Fig. 29: AHRS Block Diagram (Sheet 2 of 2)

FAULT INDICATION

Table 5: Air Data System – CAS Messages

CAS MESSAGE	LOGIC
AHRS 1 BASIC	AHRS 1 has lost TAS input
AHRS 2 BASIC	AHRS 2 has lost TAS input
AHRS 1-2 BASIC	AHRS 1 and 2 have lost TAS input
AHRS 1 FAULT	At least one of the AHRS 1 system messages has been triggered
AHRS 2 FAULT	At least one of the AHRS 2 system messages has been triggered
AHRS 1-2 FAULT	Both AHRS have had at least one system message triggered

RUNWAY/TAXIWAY SITUATIONAL AWARENESS

(ATA 34-31-00)

OVERVIEW

The runway/taxiway situational awareness system consists of a Safe Taxi serial data enablement card. Safe Taxi provides alerts, indications, and visual cues to help the flight crew maintain situational awareness and avoid potential runway incursions during ground and air operation in the airport environment.

COMPONENT DESCRIPTION

SD Card

Processing for the runway/taxiway situational awareness system occurs within each display unit independently. Inputs for this function are the Safe Taxi database that resides on the bottom SD card of each display.

SYSTEM OPERATION

The basic Safe Taxi feature gives greater map detail when viewing airports at close range. The maximum map ranges for enhanced detail are pilot-configurable. When viewing at ranges close enough to show the airport detail, the map automatically reveals taxiways with identifying letters/numbers, airport hot spots, and airport landmarks, including ramps, buildings, control towers, and other prominent features. Resolution is greater at lower map ranges. When the MFD display is within the Safe Taxi ranges, the airplane symbol on the airport provides enhanced position awareness.

Designated hot spots are recognized at airports with many intersecting taxiways and runways, and/or complex ramp areas. Airport hot spots are outlined to caution pilots of areas on an airport surface where positional awareness confusion or runway incursions happen most often. Hot spots are defined with a magenta circle or outline around the region of possible confusion.

During ground operations the aircraft position is displayed in reference to taxiways, runways, and airport features. When panning over the airport, features such as runway holding lines and taxiways are shown at the cursor.

SYSTEM INTERFACE

Figure 30

Inputs for this function are the Safe Taxi database that resides on the supplemental database cards on each display unit.

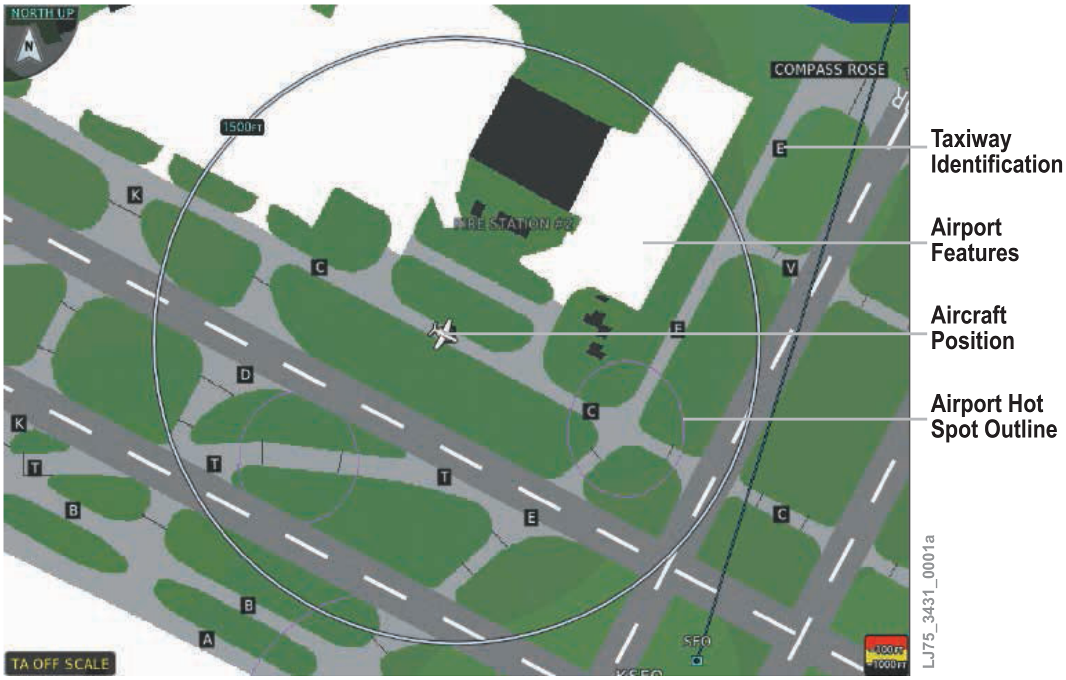


Fig. 30: SafeTaxi Depiction on the Navigation Map Display

WEATHER RADAR SYSTEM

(ATA 34-42-00)

OVERVIEW

The weather radar system is a single-unit radar used for atmospheric moisture detection and ground mapping. When the system is in the weather detection mode, it will detect and locate various types of inclement weather conditions along the flight path of the aircraft and provide a visual-color display of storm intensities. When the system is used for ground mapping, the display will enable the crew to identify coastlines, hilly or mountainous regions, cities, or large structures.

The maximum permissible exposure limit (MPEL) is 11 ft for this radar.

COMPONENTS

Figure 31

The weather radar system consists of:

- Receiver/transmitter/antenna (RTA) unit

COMPONENT DESCRIPTION

Weather Radar RTA

The RTA is a 12-inch plate and is installed inside the radome on the forward side of frame 1.

Software and configuration is loaded through PFD 1 via a serial data card. The RTA is a solid state weather radar with 50-watt transmit power. The RTA has a azimuth sweep range of ±60° and a elevation sweep of ±30°.

The display range is 2.5 to 320NM. The weather radar system has supported features as follows:

- Weather target alert to annunciate the presence of significant weather
- Automatic range limiting
- Vertical scan
- Altitude compensating tilt
- Pilot selectable receiver gain
- Ground mapping capability

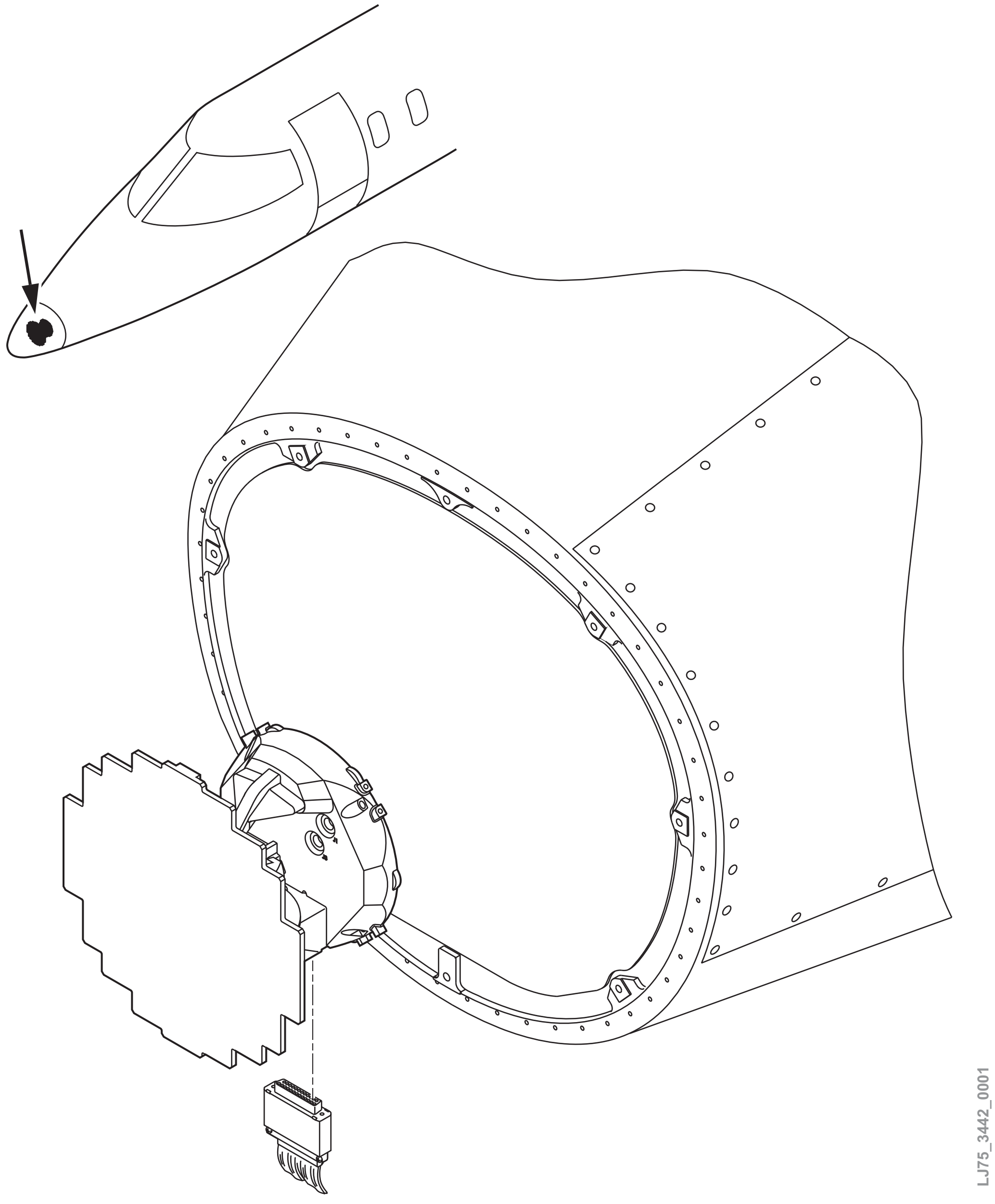


Fig. 31: Weather Radar System

SYSTEM OPERATION

Inputs

- Heading, pitch, and roll data is used to support stabilization
- GPS ground speed is used to support ground clutter suppression
- Barometric altitude is used to support altitude compensated tilt
- All data used by the weather radar system is provided via HSDB

Power is supplied to the RTA by the WXR circuit breaker on the copilots circuit breaker panel.

Power to the radar is provided by the right main avionics bus.

Weather Radar System

Control of the weather radar system is provided by the touch controllers (GTCs).

Automatic Stabilization—Antenna tilt can be automatically stabilized based on pitch and roll data provided via HSDB. This function is enabled/disabled via GTC and is annunciated on the weather map.

Vertical Tilt—Manual adjustment of vertical tilt via GTC joystick (push to enter bearing/tilt control mode). Graphical icon on MFD clarifies bearing/tilt control when in bearing/tilt control mode. Steps of 0.25° up to ± 15°. Direction DN/UP shown. Tilt value is stored across power cycles.

Gain Control—Changes the precipitation intensity to be displayed as a color not representative of the true intensity. Used to determine how close the displayed intensity is to the next higher/lower level. Gain is adjusted by the slider on the GTC. Calibrating gain button restores the gain to that corresponding to actual intensity.

Weather Alert—Indicates the presence of heavy precipitation between the ranges of 80 and 320 NM regardless of the currently displayed range. Weather alert targets appear as red bands along the outer range ring at the approximate azimuth of the detected returns. If weather alert is detected within ± 10° of the aircraft heading, a system message “WEATHER ALERT- possible severe weather ahead” is posted. this function is enabled/ disabled by GTC softkey.

Turbulence Detection—This function is optional and available in weather mode only. Utilizes doppler radar out to 40 NM to both see the precipitation along the radar beam. Allows the radar to measure how fast rain or hail is moving toward or away from the radar. Does not detect clear air turbulence. Beyond 40 NM, other techniques such as pulse pair processing and 2D filtering are used in addition to doppler for effective ground clutter suppression. This function is enabled/disabled via the GTC.

Ground Clutter Suppression—This function is an option and is available with an enable SD card. Ground clutter is removed from the display using doppler out to a range of 40 NM. Beyond 40 NM, other techniques such as pulse pair processing and 2D filtering are used in addition to doppler for effective ground clutter suppression. This function is enabled/ disabled via the GTC.

Altitude Compensated Tilt (ACT)—Allows the ground weather radar to automatically change the pitch of the antenna based on the

aircraft height. The closest ground return is used as a reference when the pitch change occurs and the sweeping vertical angle remains unchanged. This function is enabled/ disabled via the GTC.

Scanning—Horizontal scanning is the default mode at power up. When paired with sector scan, allows the crew to select from 20,40, 60,90, and full (120). Full is the default at powerup. This function is selected via the GTC and annunciated on the MFD. Vertical scanning allows for crew selection of select an azimuth (bearing) and scan a storm cell to other area vertically. Sector scan of 60 (±30) is always used. Bearing can be selected in one-degree increments left and right using the GTC joystick (push to enter bearing/tilt control mode).

Weather Attenuated Color Highlight (WATCH)—Determines areas of possible inaccuracies in displayed intensity due to weakening (attenuation) of the radar energy due to intense precipitation, or distance. Displays grey shading in areas where the intensity of returns is suspect. This function is enabled/disabled via the GTC.

Range—Function is controlled by turning the GTC joystick. Range markers show up on the radar map. Range supported up to 320 nm. Range values are stored across power cycles.

Display

In weather mode, the system displays precipitation in black, green, yellow, and red. In ground map mode, the system displays different reflections in black, light blue, yellow, magenta, and blue. Weather overlay is available on the main map. The overlay is mutually exclusive with datalink radar and terrain overlays.

The weather radar system allows for four different scans to occur at the same time (PFD1, PFD2, MFD left pane, MFD right pane). Sync scan allows the crew to synchronize or separate control between displays.

Modes

Weather—Airborne weather detection

Ground map—Presentation of terrain or detection of water boundaries

Standby—Switches to this mode automatically on landing

Test—Generates a test pattern

Weather/turbulence—Provides both weather and turbulence detection features

SYSTEM INTERFACE

Figure 32

The AHRS provides stabilization input to the RTA. Control interface between the RTA and cockpit controller is through a private line serial data bus.

Video data is transmitted from the RTA to the display units and control data will be transmitted from the flight management computers through private line serial data busses.

The serial control interface (SCI) connects the RTA and the flight management computers.

The picture buses (WXPD) connect the RTA and the display units.

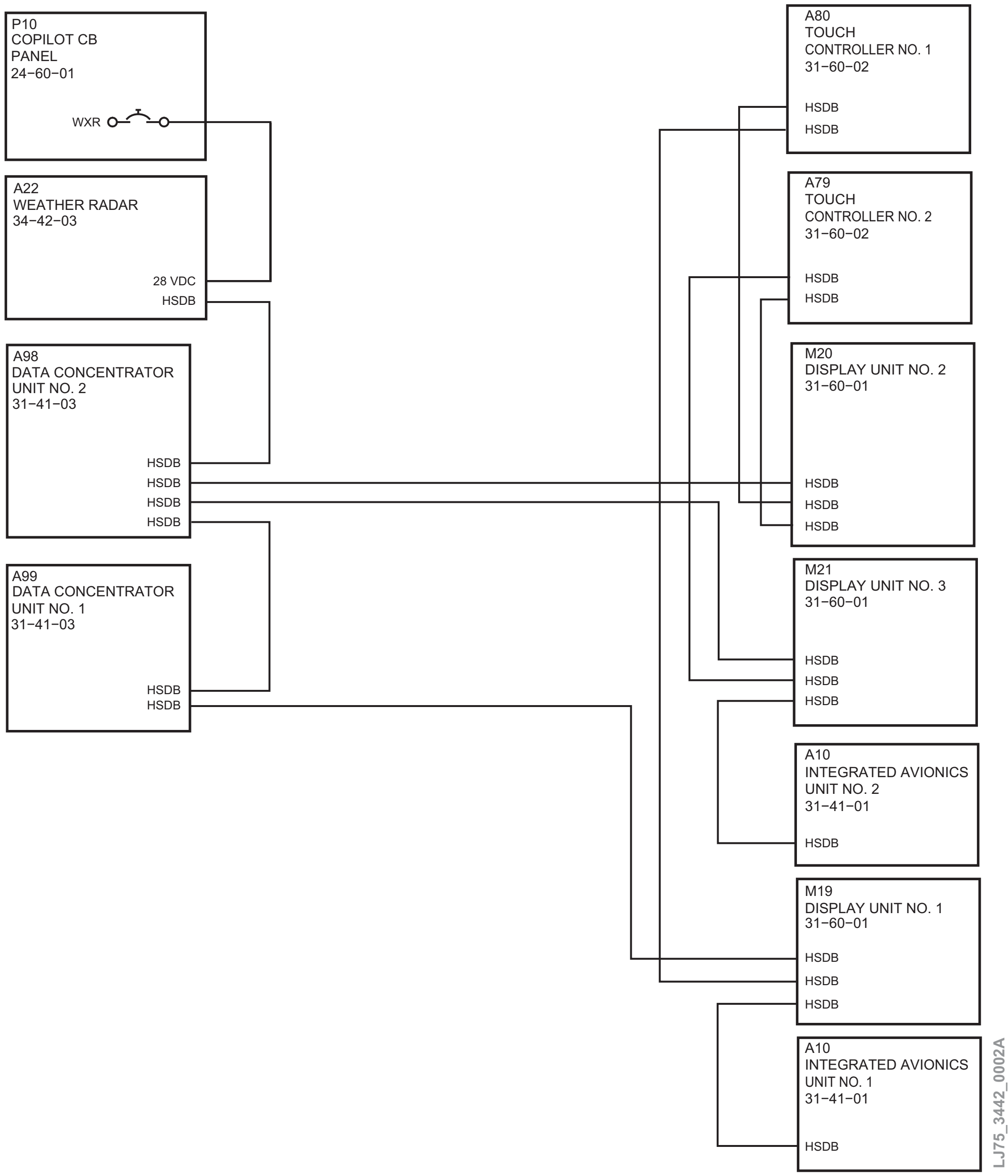


Fig. 32: Weather Radar System Block Diagram

FAULT INDICATION

Table 6: Weather Radar System – CAS Messages

CAS MESSAGE	DESCRIPTION
WX RADAR FAULT	The GWX failed or needs service
GTC MESSAGE	WX alert – possible severe weather ahead

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS II)

(ATA 34-43-00)

OVERVIEW

TCAS II is an airborne traffic alert, collision avoidance, and resolution advisory system. The TCAS II system operates in conjunction with the transponder to interrogate the transponders of other aircraft and monitor their replies.

TCAS II tracks and continuously evaluates the threat potential of the responding aircraft and displays them on display unit no. 2. During threat situations, TCAS II provides traffic advisories and resolution advisories to assist the pilot in avoiding midair collisions.

COMPONENTS

Figure 33

The TCAS II system consists of the following:

- TCAS II processor
- TCAS II antennas (2)

ASSOCIATED COMPONENTS

Touch controllers (2)

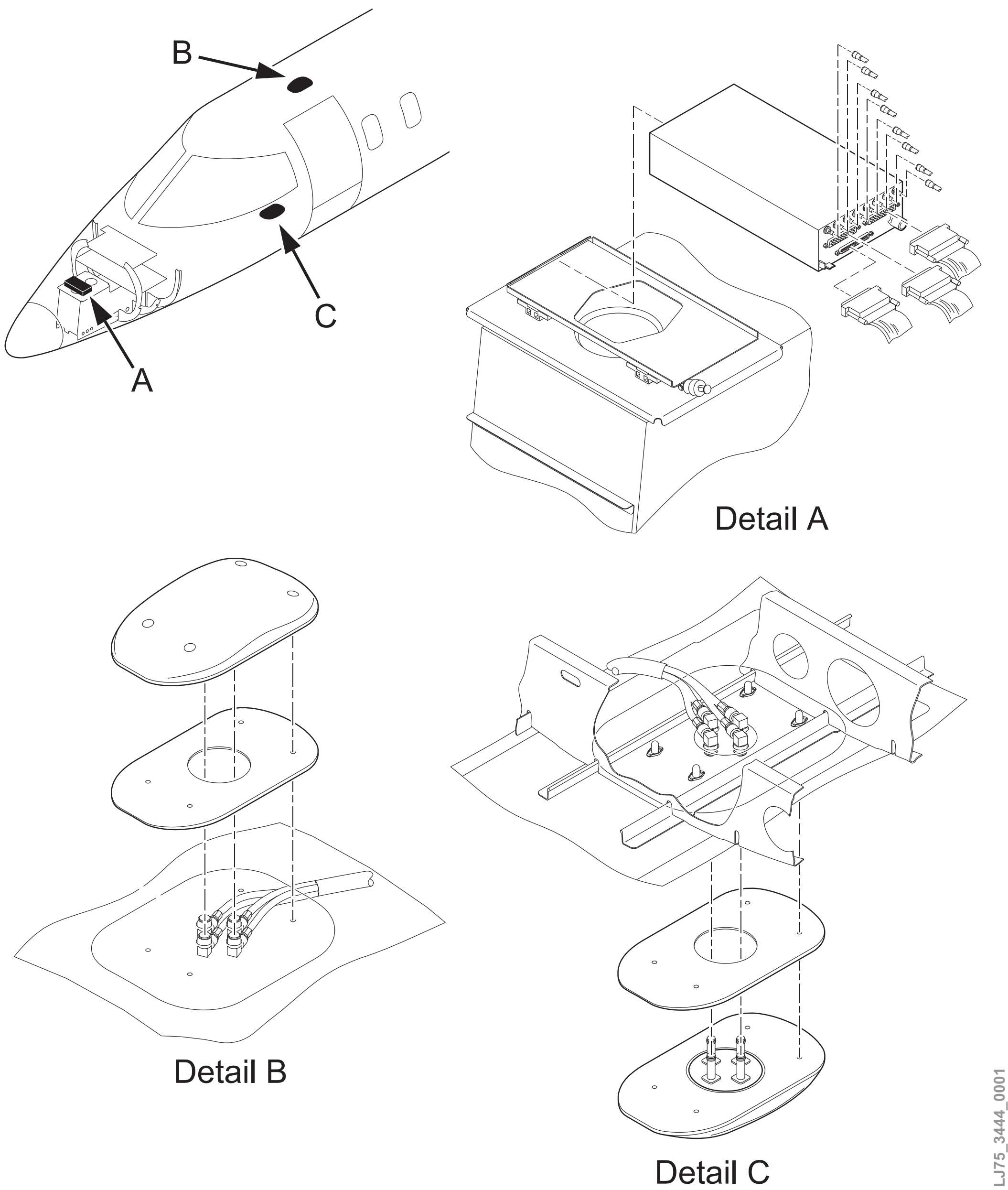


Fig. 33: Traffic Alert and Collision Avoidance System

COMPONENT DESCRIPTION

TCAS II Processor

Figure 33

The TCAS II processor is located in the nose compartment at approximately FS126. The processor interfaces with the TCAS antennas, controls, displays and other aircraft systems.

The TCAS II processor transmits transponder interrogation signals and monitors all replies. The range, bearing and closure rate of the responding aircraft are then computed.

If a responding aircraft is equipped with an altitude reporting transponder, its altitude and vertical speed are also determined.

TCAS II Antennas

Figure 33

The TCAS II antennas are located along the centerline of the fuselage. The antennas are installed on the top and bottom of the aircraft to prevent intruder aircraft from being shielded by the airframe.

The TCAS II antennas are located on the top and the bottom of the aircraft. Each antenna is a four element, vertically polarized, monopole array that can transmit in any direction as selected, and receive from all directions simultaneously.

ASSOCIATED COMPONENT DESCRIPTION

Touch Controllers

TCAS II is controlled through the touchscreen controllers using the Traffic and corresponding

Settings button. The Settings button controls symbols and range.

Transponders

The TCAS II system includes two diversity Mode S transponders which provide enhanced surveillance and two-way communications capability for ATC and TCAS operations. It has antenna diversity from the directional antennae enabling receipt of coded signals containing information such as aircraft identity, altitude, and data messages from ground stations or other aircraft, and transmitting coded replies. Only one transponder is operational at any one time; the other acts as a backup and is selectable at any time by the crew.

SYSTEM OPERATION

Modes of Operation

The system operational modes are TA/RA, TA-only or Test Mode. The TA/RA mode is the normal operating mode, displaying information of aircraft in the surrounding airspace and generating traffic advisories or resolution advisories as conditions demand.

In TA-only mode, resolution advisories are not generated and traffic information only is displayed.

Test Mode, when selected, will confirm correct operation of the TA, RA, and aural advisories.

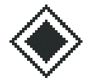
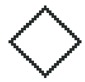
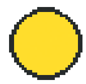
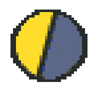
Indications

Figures 34, 35 and 36

Responding aircraft are displayed on display unit no. 2 (DU2) as colored symbols positioned to depict their relative bearing and distance. If available, their altitudes are also displayed along with arrows to denote climb or descent rates of greater than 500 ft per minute. The vector line that extends beyond the point of the traffic arrow is just further indication of the intruder aircraft track.

When TCAS II calculates that a responding aircraft is on a conflicting path, it issues an aural traffic advisory to alert the flight crew that closing traffic is in the area. If the intruder continues to close, TCAS II will issue a visual and aural resolution advisory to maintain safe vertical separation. If the intruding aircraft is also equipped with TCAS II, both resolution advisories will be coordinated using the Mode S transponder data link.

Visual resolution advisories are displayed as red or green arcs on the perimeter of the vertical speed indicators, on DU1 and DU3. A green arc indicates the range of vertical speed to be maintained and a red arc indicates the range of vertical speed to be avoided.

Traffic Symbol	Description
	Non-Threat Traffic
	Proximity Advisory (PA)
	Traffic Advisory (TA)
	Traffic Advisory Off Scale
	Resolution Advisory (RA)
	Resolution Advisory Off Scale

LJ75_3443_0001

Fig. 34: TCAS II Traffic Symbol Description

Fig. 35: Traffic Annunciation with Resolution Advisory (PFD)

Climb

Descend

Maintain, Don't Climb

Maintain, Don't Descend

Maintain, Don't Climb and Don't Descend

Adjust Vertical Speed

Fig. 36: Example Resolution Advisory Displays

POWER

Figure 37

Power is supplied to the TCAS II processor through a 3 amp circuit breaker on the copilot CB panel. The TCAS circuit breaker is powered by the right main AV bus.

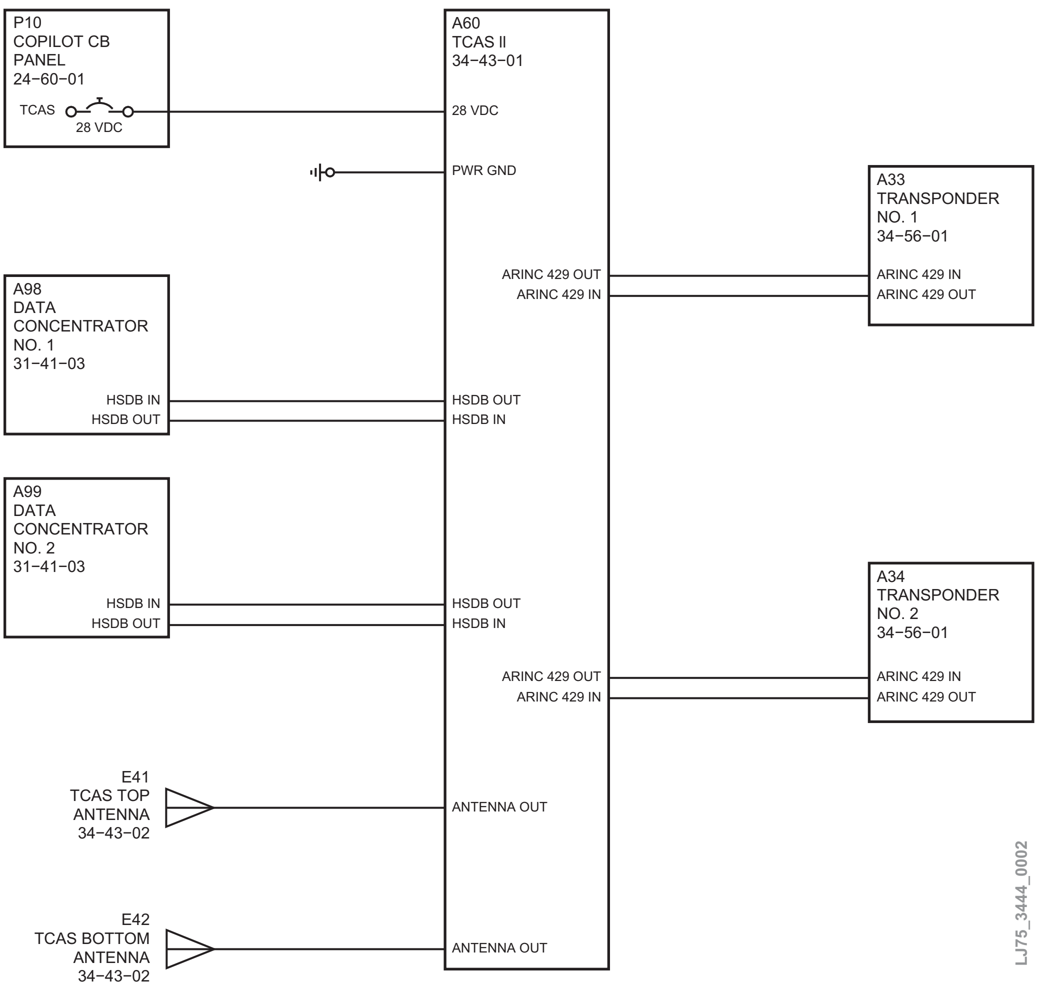


Fig. 37: TCAS II Block Diagram

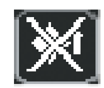
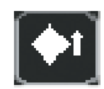
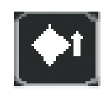
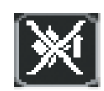
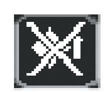
FAULT INDICATION

System Status

Table 7

The traffic mode is annunciated in the upper-left corner of the Traffic Map window.

Table 7: TCAS II Traffic Status Annunciations

MODE	PFD MODE ANNUNCIATION	MFD TRAFFIC MAP PAGE MODE ANNUNCIATION	TRAFFIC DISPLAY STATUS ICON (OTHER MAPS)
TCAS II Self-Test Initiated (TEST)	None	**TEST** **TEST MODE (top center of page)**	
Traffic Advisory and Resolution Advisory (TA/RA)	None	**TA/RA**	
Traffic Advisory Only (TA ONLY)	TA ONLY	**TA ONLY**	
TCAS II Standby (TFC STBY)	TCAS STBY or TCAS STBY	**STANDBY** **STANDBY (center of page on ground)** **STANDBY (center of page in the air)**	
TCAS II Failed	TCAS FAIL	**FAIL**	

TCAS II Failure Annunciations

Table 8

Table 8: TCAS II Failure Annunciations

TRAFFIC MAP PAGE ANNUNCIATION	LOGIC
NO DATA	Data is not being received from the TCAS II unit
DATA FAILED	Data is being received from the TCAS II unit, but the unit is self-reporting a failure
FAILED	Incorrect data format received from the TCAS II unit

TCAS II Traffic Status Annunciations

Table 9

The annunciations to indicate the status of traffic information appear in a banner at the lower-left corner of maps on which traffic can be displayed.

Table 9: TCAS II Traffic Status Annunciations

TRAFFIC STATUS BANNER ANNUNCIATION	LOGIC
RA OFF SCALE	Resolution Advisory is outside the selected display range[1] Annunciation is removed when traffic comes within the selected display range
TA OFF SCALE	Traffic Advisory is outside the selected display range[1] Annunciation is removed when traffic comes within the selected display range
RA X.X ± XX <UP> OR <DN>	System cannot determine bearing of Resolution Advisory[2] Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend <UP> for climbing <DN> for descending traffic
TA X.X ± XX <UP> OR <DN>	System cannot determine bearing of Traffic Advisory[2] Annunciation indicates distance in nm, altitude separation in hundreds of feet, and altitude trend <UP> for climbing <DN> for descending traffic
TRFC FAIL	TCAS II unit failed (unit is self-reporting a failure or sending incorrectly formatted data)
NO TCAS DATA	Data is not being received from the TCAS II unit

1. Shown as symbol on Traffic Map page
2. Shown in center of Traffic Map page

TERRAIN AWARENESS WARNING SYSTEM (TAWS)

(ATA 34-45-00)

OVERVIEW

The Terrain Awareness Warning System (TAWS) - Class A (TAWS-A) provides increased situational awareness and aids in reducing controlled flight in to terrain (CFIT). TAWS-A provides visual and aural annunciations when terrain and obstacles are within the given altitude threshold from the aircraft. The displayed alerts and warnings are advisory in nature only.

Synthetic vision provides the pilot with a greater awareness of the aircraft position relative to surrounding terrain, obstacles, and traffic. This is to be accomplished by placing a three dimensional depiction of terrain, obstacles, and traffic in the primary field of view such that their proximity is more easily understood during instrument scanning.

ASSOCIATED COMPONENTS

- Display units (DUs)
- GTC touch controllers

COMPONENT DESCRIPTION

The TAWS calculations are performed by the display units (DUs).

SYSTEM OPERATION

The TAWS system is active when DC power is applied to the aircraft, the avionics master switches are on, and the TAWS FAIL and WINDSHR FAIL annunciators are not on.

The system requires inputs from the following systems:

- Air data computer (ADC)
- Attitude heading reference system (AHRS)
- VHF navigation
- Flap position
- Landing gear position
- Radio altimeter
- Stall warning vane position

System output is through the audio system and warning lights. Voice warnings are transmitted through the cockpit speakers and the headphones.

NOTE

Voice warnings generated by TAWS have priority over voice warnings generated by the traffic alert collision avoidance system (TCAS) and all other aural alerts.

TAWS-A

TAWS-A uses information from the GPS receiver to provide a horizontal position and altitude, along with additional altitude input from the radio altimeter. GPS altitude is

derived from satellite measurements. GPS altitude is converted to a mean sea level (MSL)-based altitude (GPS-MSL altitude) and is used impart to determine TAWS-A alerts.

GPS-MSL altitude does not require local altimeter settings to determine MSL altitude.

The terrain and obstacle databases used by TAWS-A are referenced to MSL. Using the GPS positions and GPS-MSL altitude, TAWS-A displays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft.

The GPS position and GPS-MSL altitude are used to calculate and predict the aircraft flight path in relation to the surrounding terrain and obstacles. In this manner, TAWS-A can provide advanced alerts of predicted dangerous terrain conditions.

The TAWS system automatically and continuously monitors aircraft flight path with respect to terrain when the aircraft is below 2450 ft radio altitude (altitude above ground level [AGL]). If projected flight path would imminently result in terrain impact, the system issues appropriate visual and voice warnings.

Warnings are issued for excessive descent rate, excessive terrain closure, descent after takeoff, missed approach, proximity to terrain with flaps and/or gear not in the landing configuration, descent below glideslope, and excessive roll or bank angle. Additionally, the system includes the capabilities of terrain clearance floor, terrain awareness, and terrain awareness display.

Visual and Aural Warning Modes

The TAWS provides aural and visual warnings of possible terrain danger under the following conditions:

MODE 1

Provides warnings for excessive descent rates with respect to radio altitude. This mode has an inner and outer warning boundary. Penetration of the outer warning boundary illuminates the PULL UP annunciators and activates the “Sink Rate” aural message. The voice message will occur at least twice and will not repeat unless penetration increases.

Penetration to the inner boundary leaves the PULL UP annunciators on, but changes the voice message to PULL UP. The descent rate required to cause the “Sink Rate” aural warning to occur is automatically increased as the aircraft is repositioned down from slightly above the glideslope centerline. Correcting flight path will stop the warning.

MODE 2

Provides warnings for excessive closure rates to terrain with respect to radio altitude, phase of flight, and airspeed.

Two types of warnings are given:

- **Mode 2A** is armed when the flaps are not in the landing configuration and the aircraft is not on an ILS approach within ±2 dots of the glideslope center. When the envelope is penetrated, the PULL UP annunciators will illuminate and the “Terrain, Terrain” aural warning followed by a continuous “Pull Up” aural warning will be given. If the terrain closure rate decreases and the gear is up, a continuous “Terrain Terrain” aural

warning will replace the “Pull Up” aural warning. The PULL UP annunciators will remain on until one of the following conditions are achieved:

- 300 ft of pressure altitude is gained.
- A safe altitude above ground level is maintained for a short time.
- The EPGWS FLAP OVRD switch is activated.

- **Mode 2B** is selected with flaps in full landing configuration or when making an ILS approach with glideslope deviation within ±2 dots. When the envelope is penetrated, the PULL UP annunciators illuminate and the “Terrain Terrain” aural warning is given. With the flaps and gear down, the “Terrain Terrain” aural warning will be followed by a repetitive “Terrain”. The lower boundary of the envelope varies with altitude rate. With the flaps or gear up, a “Pull Up” aural warning will be given when the “Terrain Terrain” aural warning is complete.

MODE 3

Warning is given for significant altitude loss after a takeoff or go-around. This mode is active after takeoff once the aircraft reaches 30 ft radio altitude and provides warnings until the aircraft exceeds 1500 ft radio altitude. This mode is also activated if a go-around is initiated from below 245 ft radio altitude with gear and flaps in the landing configuration. Raising the gear and/or flaps signals the system that a go-around has been initiated. If the altitude loss warning boundary is penetrated, the PULL UP annunciators illuminate and the “Don’t Sink” aural warning activates. The aural warning is repeated twice unless altitude loss continues to accumulate.

MODE 4

Warning is given for insufficient terrain clearance with respect to aircraft configuration and airspeed. These warnings are given even with low closure rates.

Three types of warnings are given under this mode:

- **Mode 4A** (Too Low Gear Warning) is activated during cruise and approach with gear up. If the aircraft penetrates 500 ft radio altitude below 190 KIAS with the landing gear up, the PULL UP annunciators illuminate and the “Too Low, Gear” aural warning is given. Above 190 KIAS, the “Too Low, Terrain” aural warning is given. The warnings will be repeated only if the aircraft penetrates further into the envelope.
- **Mode 4B** (Too Low Flap Warning) is active during cruise and approach with gear down and flaps not in landing configuration (40°). If the aircraft penetrates 245 ft radio altitude below 160 KIAS with the flaps not in landing configuration, the PULL UP annunciators illuminate and the “Too Low, Flap” aural warning is given. Above 160 KIAS, the “Too Low, Terrain” aural warning is given. The warning will be repeated only if the aircraft penetrates further into the envelope.

- **Mode 4C** (Too Low Terrain Warning) provides terrain warning after takeoff or go-around. This mode is activated after takeoff at 100 ft AGL and provides warnings until the aircraft exceeds 2450 ft radio altitude. This mode is also activated if a go-around is initiated from below 245 ft radio altitude with gear and flaps in the landing configuration. Raising the gear and/or flaps signals the system that a go-around has been initiated. The mode is based on a minimum terrain clearance, or floor, that increases with radio altitude that has occurred during takeoff. If the aircraft penetrates the floor, the PULL UP annunciators illuminate and the “Too Low, Terrain” aural warning is given. The warning will be repeated only if the aircraft penetrates further into the envelope.

MODE 5

Provides alerts for excessive glideslope deviation when the aircraft descends below the glideslope on a front course ILS approach. If the aircraft rate of descent exceeds 500 ft per minute, alerts are given below 1000 ft radio altitude when glideslope deviation exceeds 1.3 dot fly-up. If the aircraft rate of descent is from 500 to 0 ft per minute, the radio altitude at which alerts are given is reduced linearly from 1000 to 500 ft radio altitude. The alert occurs at two audio levels. When the glideslope deviation reaches 1.3 dot fly-up, the BELOW G/S annunciators will illuminate and the soft “Glideslope” aural alert will be given. The “Glideslope” aural alert in the “soft” area will be given once and repeated only if the condition worsens. Below 300 ft radio altitude and deviation of 2.0 dots fly-up or more, the louder “Glideslope” aural alert is given. A “Glideslope” aural in the “louder” area will be repeated at an increased rate.

MODE 6

Provides alerts and callouts for descent below predefined altitudes, decision height (DH), minimums, approaching decision height and approaching minimums. A “Smart” five hundred foot callout is also provided. This callout will only be issued when the system detects that a non-precision approach is being performed or that the aircraft is outside ±2 dots glideslope or localizer deviation.

The Smart callout is disabled whenever ALL of the following conditions occur:

- Terrain awareness and geometric altitude functions are active and of high integrity
- The aircraft is within 5 nm of the runway
- The aircraft is within 3500 ft of the runway elevation

Reactive Windshear Detection

The reactive windshear detection function provides caution and warning alerts when a windshear condition is detected. One DU is considered the “master” at a given time and identifies when to trigger an alert for all other DUs.

DUs that are not the master perform reactive windshear calculations, but do not trigger alerts. These DUs are available to become the master in the event that the current master becomes inoperative due to input data failure or internal failure.

Windshear warnings and cautions are provided between 10 and 1500 ft AGL during the initial takeoff and the final approach

phases of flight when the level of windshear exceeds predetermined threshold values.

The actual windshear value, which is measured, represents the vector sum of inertial and air mass accelerations along the flight path and perpendicular to the flight path. These shears result from vertical winds and rapidly changing horizontal winds.

Windshear warning alerts are given for decreasing head wind (or increasing tail wind) and severe vertical down drafts.

Windshear warning alerts activate the red WINDSHEAR annunciators and a siren is sounded, followed by “Windshear, Windshear, Windshear” aural warning.

The aural warning will not repeat unless another event occurs, but the WINDSHEAR warning annunciator remains on for as long as the condition persists.

Windshear caution alerts are given for increasing head wind (or decreasing tail wind) and severe updrafts typically associated with the leading edge of microburst windshears.

The windshear caution WINDSHEAR annunciators and a siren is sounded, followed by “Caution Windshear, Caution Windshear, Caution Windshear” aural warning.

The WNDSHEAR caution annunciator remains on for as long as the condition persists. The WINDSHEAR annunciation caution (amber) and warning (red) alerts are displayed on the PFDs above the HSI.

The DU uses sensor data as follows:

- True airspeed
- Angle of attack
- Attitude (pitch and roll)
- Heading
- GPS velocity
- Altitude above ground (radar altimeter or GPS)

TAWS Controls

Controls for TAWS are performed using the GTCs.

Alerts are activated or deactivated from the Home page, TAWS, Settings. Enabling or disabling data is from the Home page, Terrain, Terrain Settings.

Synthetic Vision Technology

Synthetic vision technology (SVT) provides the pilot with a greater awareness of the aircraft position relative to surrounding terrain, obstacles, and traffic. This is accomplished by placing a three-dimensional depiction of terrain, obstacles, and traffic in the primary field of view such that their proximity is more easily understood during instrument scanning.

The pilots interface on the PFD with SVT include a:

- Perspective depiction of surrounding terrain
- Perspective depiction of runways
- Zero pitch line
- Perspective depiction of large bodies of water such as oceans, major rivers, and large lakes
- Perspective depiction of obstacles
- Flight path marker

SVT Display on the PFD

STANDARD

Standard PFD features are presented in front or drawn on top of SVT features. All SVT elements except the FPM and horizon marks are depicted with a 3-D perspective view so that the size on the screen is relative to the distance from the airplane.

The frame of reference of SVT is aligned with the aircraft body frame. Consequently, SVT is egocentric and attitude-aligned. The frame of reference position is GPS-derived latitude and longitude, and the frame of reference elevation is GPS-derived geoidal altitude. GPS-derived altitude is adjusted for the navigation center offset from the aircraft installation.

When SVT is enabled, the following prioritization (lowest to highest) is used to determine what is displayed in the event of a conflict:

- SKY
- Synthetic vision (except the flight path marker)
- Protective ground and sky bands
- Pitch ladder and zero pitch line
- Flight path marker
- Aircraft representative symbol and flight director command bars.
- All other PFD functions

INVALID SVT

Invalid SVT is indicated by reverting to the standard blue-over-brown display.

SVT is considered invalid in any of the circumstances as follows:

- When terrain data is not available
- When terrain data coverage is not better than or equal to 9 arc-seconds (this condition is annunciated on the PFD)
- When obstacle data is not available
- When the terrain alerting function (TAWS-A, TAWS-B, or TERRAIN-SVS, as applicable) is not available or failed
- When SVT fails or freezes
- When the input position, attitude, or heading data is invalid

DISPLAY

The foundation of the SVT is a three-dimensional perspective depiction of nonstructural terrain features based on the terrain database.

Elevations are with respect to MSL. Terrain coloring is consistent with that of the topographical display on the plan-view moving map.

A persistent indication of ground and sky is displayed to facilitate unusual altitude recovery.

Black gridlines denoting a one arc-minute (approximately one nautical mile) grid are also depicted on the terrain.

Terrain is displayed with texturing to provide a sense of movement relative to the ground.

Terrain conflict coloring is based upon forward looking terrain avoidance (FLTA) alerts from TAWS-A or TERRAIN-SVT.

Any terrain point within 600 meters of an FLTA impact point (denoted as an X on the moving map displays) is colored either red or yellow to match the FLTA criticality.

Terrain shading used on the moving map displays (based on relative altitude to the aircraft) is not displayed on the SVT display.

OBSTACLES

Obstacles are all fixed and mobile objects, or parts thereof, that are on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect the aircraft in flight. These nonterrain objects and cultural features are depicted on the SVT display if their highest point is within 1000 ft vertically of the aircraft. SVT obstacles symbology consists of three dimensional representations of the corresponding symbols used on the plan-view moving map. The top of the obstacle depiction (minus any lighting indications) is placed at the highest altitude in the database for that obstacle.

- Obstacle symbols are grey in color unless they are the source of an FLTA alert
- Obstacles that correspond to an FLTA alert from TAWS-A, TAWS-B, TERRIAN-SVS are colored red or yellow to match the FLTA criticality.
- Obstacle coloring does not match obstacle coloring on the moving map
  - The coloring matches the color of the impact point (displayed as an X on the moving map or terrain displays) for an FLTA with an obstacle

ZERO-PITCH LINE

A zero-pitch line is drawn completely across the display to represent the artificial horizon. The line will not always be aligned with the terrain horizon; particular when the terrain is sloped or mountainous. Terrain above the aircraft altitude will appear above the zero-pitch line and terrain below the aircraft altitude will appear below the zero-pitch line.

HEADING MARKS

Heading marks are depicted immediately above the zero-pitch line and are spaced in 30° increments. Horizon heading marks follow the system setting for true vs. magnetic heading mode. When activated, heading tick marks and digits appearing on the zero pitch line are not visible when they are behind either the airspeed to altitude tapes.

RUNWAY DATA

Runway data from the navigation database is superimposed upon the terrain data to provide a greater awareness of where the runway lies with respect to the surrounding terrain. Each runway surface includes runway designations (numbers) depicted at he end of each runway. Runway thresholds are also depicted. Hard surface runways are displayed in grey coloring and soft surface runways are displayed green in color. Runway surfaces and labels are visible if either runway endpoint is within 2 nm of the airplane. Runway centerlines are displayed on hard surface runways as a dashed white line.

AIRPORT SIGNAGE

Airport signs are depicted as four white lines that form a rectangular box, one white line that

forms a signpost, and a translucent black background inside the rectangular box. When activated, airport signs appear on the display at approximately 15 nm from an airport and disappear at approximately 4.5 nm. Airport signs depict the airport identifier if the airport is within approximately 8.5 nm of the airplane. Airport signs are not shown when they are behind any primary flight instrument tapes or the HSI.

WATER

Large bodies of water such as oceans, major rivers, and large lakes are depicted on the SVT display. Terrain conflict symbology is indicated by changing the color of the water to correspond to the color of the terrain alert for an area around the alert.

TRAFFIC

Traffic is depicted in SVT in a three-dimensional perspective view. Traffic symbology consists of three dimensional representations of the corresponding symbols on the plan-view moving map.

TRAFFIC SYMBOLS

Traffic symbols are shown with increasing size as the distance to the intruder aircraft is reduced, up to a maximum size of 10° of vertical field of view when the traffic is 3000 ft. away. For distances less than 3000 ft., the displayed size remains constant. Traffic is not depicted if it is within 250 ft laterally of the airplane's current location, since it could obscure other SVT data.

TRAFFIC IN SVT

Traffic in SVT was designed to be displayed at a size that is considered visible when the traffic is 10 nm from the aircraft. Beyond 10 nm, the traffic display may be scaled to a size that is not visible.

TRAFFIC SYMBOL COLORING

Traffic symbol coloring is the same as that of the plan-view moving map, subject to the below differences. All standard traffic symbols are displayed on the SVT view with the exception of off-scale traffic. In the SVT view, there is no concept of off-scale traffic (there is no reference on the SVT display that corresponds to the selected scale on the traffic display), so even if an intruder is off the scale on the traffic display (and displayed as such), it will be displayed on the SVT display as in its normal traffic advisory state. However, if the intruder is further than 10 nm away, the intruder's display on SVT may be scaled to a size that is not visible.

TCAS II ADVISORIES

TCAS II resolution advisories are displayed in SVT.

TRAFFIC ADVISORY

Traffic Advisory (TA) with directional information (normally a yellow arrow) is displayed as a TA without directional information (SVT simply displays a yellow circle). This is because the symbol is designed for a top down map and does not map well into 3D space.

TA without directional information (yellow circle) is displayed the same as on the traffic page. Non-threat traffic with directional

information (normally a white arrow) is displayed as Proximity Advisory (PA) traffic (filled white diamond) in SVT. This is because the symbol is designed for a top down map and does not map well into 3D space.

Non-threat traffic with no directional information (filled white diamond) is displayed the same in SVT as on the traffic page. All other ADS-B symbols are displayed in SVT as hollow white diamonds. The degraded traffic symbol is not supported by SVT.

FLIGHT PATH MARKER

The flight path marker (FPM), also known as a velocity vector, is depicted on top of the other SVT display features and behind the remainder of the standard PFD features.

The FPM position is projected from the GPS-derived position and altitude and is generally projected forward along the GPS velocity vector.

For short-term accuracy, the FPM solution is augmented by acceleration data from the AHRS, processed through a low-pass filter. The FPM is invalidated when the groundspeed is less than 30 kt or when SVT is invalidated.

PITCH LADDER SCALE

When SVT is enabled, the pitch ladder scale changes from the normal scale, and labels are marked at 5° increments instead of 10.

The pitch ladder reverts to the standard scale when SVS is disabled.

MFD NAVIGATION MAP

The PFD lateral field of view (FOV) can be depicted on the MFD navigation map so that the SVS depictions can be correlated with the two-dimensional exocentric MFD view. The FOV indication can be turned on or off via the map setup menu on the MFD. The FOV indication provides strategic awareness of terrain, obstacles, or waypoints that are beyond the field of view. The PFD lateral field of view is not selectable for depiction on the MFD unless SVT is unlocked in configuration (via SVT enable card).

CONTROL FOR SVT

Control for the SVT are available on the PFD under the SYN VIS softkey menu, which is accessible via the PFD softkey. The system retains these SVT softkey settings across power cycles. SVT alerting is performed by the GTC home, Terrain, Terrain Settings. SVT softkeys on the PFDs are as follows:

SYN TERR—Enables/disables the display of SVT. A configuration option is available to synch the status of the SYN TERR softkey on PFD1 and PFD2.

HRZN HDG—Enables/disables the horizon heading marks. Note that SYN TERR must be enabled to allow selection of this softkey.

APTSIGNS—Enables/disables airport signs. Note that SYN TERR must be enabled to allow selection of this softkey.

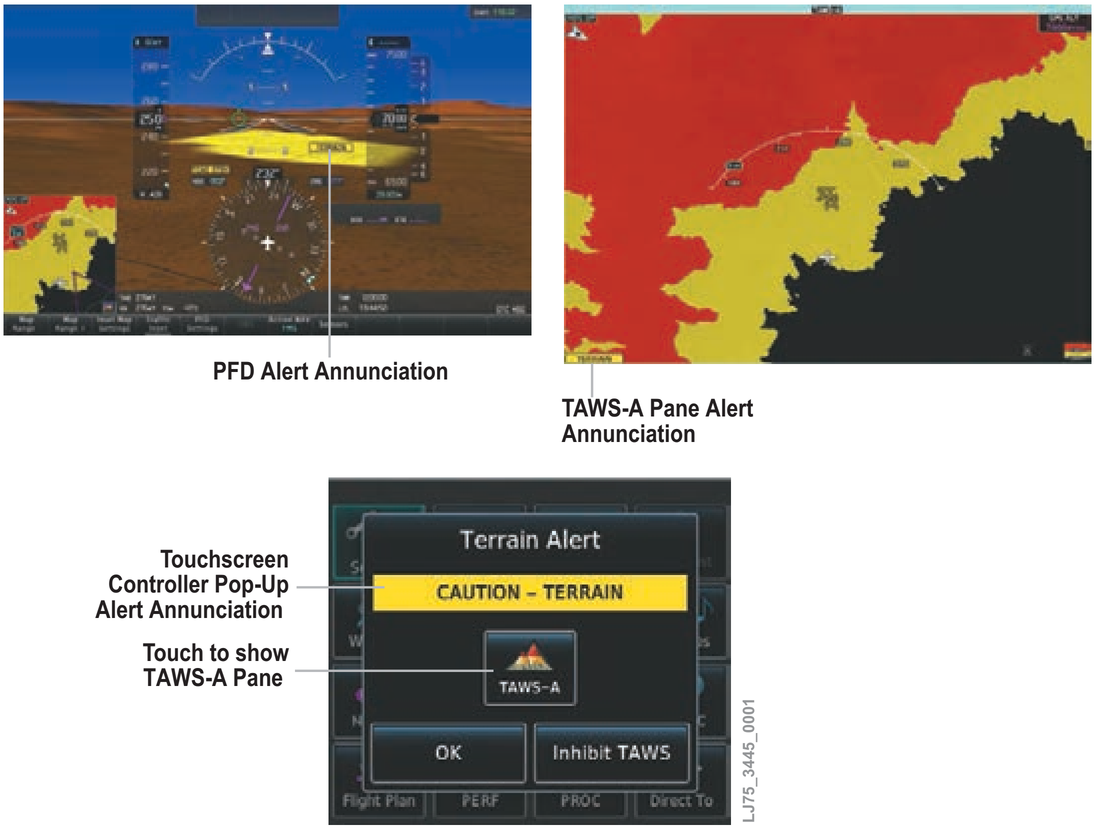


Fig. 38: TAWS-A Alert Annunciations

FAULT INDICATIONS

Table 10

Table 10: TAWS – EICAS Messages

EICAS MESSAGE	LOGIC
SVS FAULT	At least one SVS system message has been triggered.

VHF NAVIGATION SYSTEM

(ATA 34-51-00)

OVERVIEW

The very high frequency (VHF) navigation system provides pilots with:

- VHF omnidirectional radio (VOR) navigation
- Localizer (LOC) navigation instrument landing system (ILS)
- Glideslope (GS) navigation
- Marker beacon navigation

COMPONENTS

- VHF navigation antennas (2)
- VHF navigation coupler
- VHF navigation splitter

Associated Components

- Integrated avionics units (2)
- Glideslope antennas
- Audio processor units (2)
- Marker beacon antenna
- Marker beacon antenna splitter
- Touch controllers (2)
- Display units (3)
- Remote controllers (2)
- Autopilot mode controller

COMPONENT DESCRIPTION

VHF Navigation Antennas

Figure 39

The VHF navigation antennas are located on either side of the vertical stabilizer. The antenna coupler is installed on BL0.0 of the empennage.

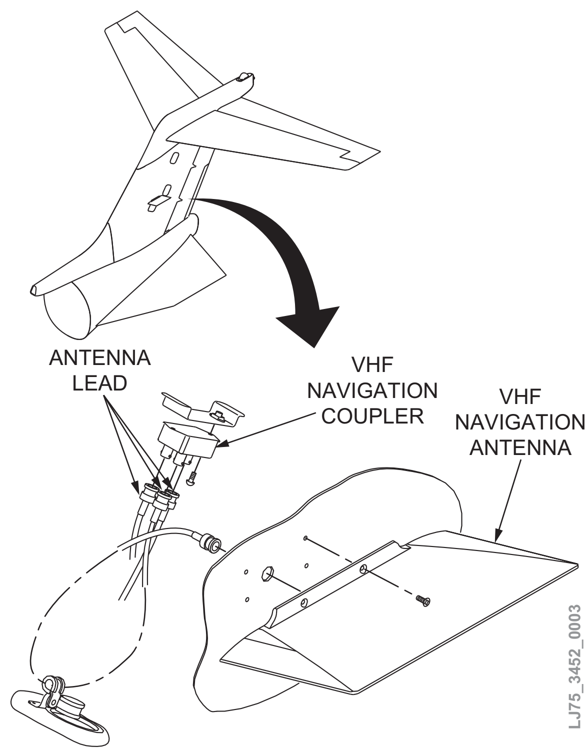


Fig. 39: VHF Antenna

VHF Navigation Splitter

Figure 40

The VHF navigation splitter is installed on the right side of the aircraft between FS614 and FS630 and between WL35 and WL45.

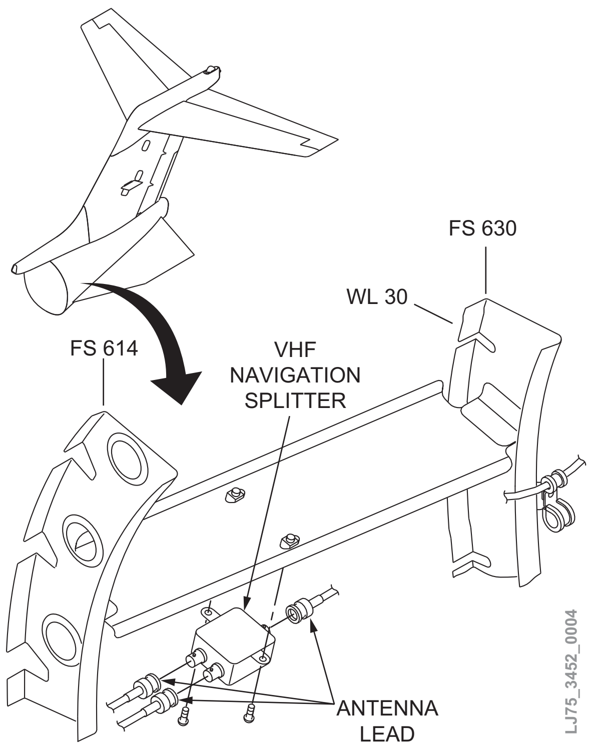


Fig. 40: VHF Navigation Splitter

ASSOCIATED COMPONENT DESCRIPTION

Integrated Avionics Units

Figure 41

The VOR/LOC navigation radios and VOR/LOC and glideslope functions are integrated in the integrated avionics units located forward of the instrument panel.

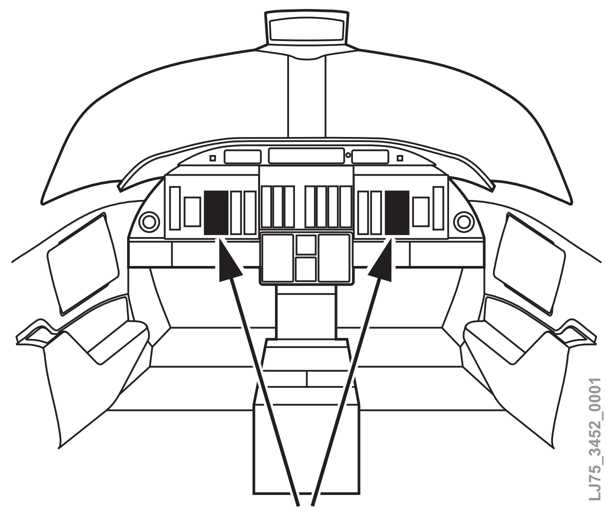


Fig. 41: Integrated Avionics Units

Glideslope Antennas

Figures 42

The glideslope antennas are installed on the inside of the radar antenna radome. The upper antenna is the primary glideslope antenna and the lower antenna is the secondary glideslope antenna. The antennas are applied with pressure sensitive tape.

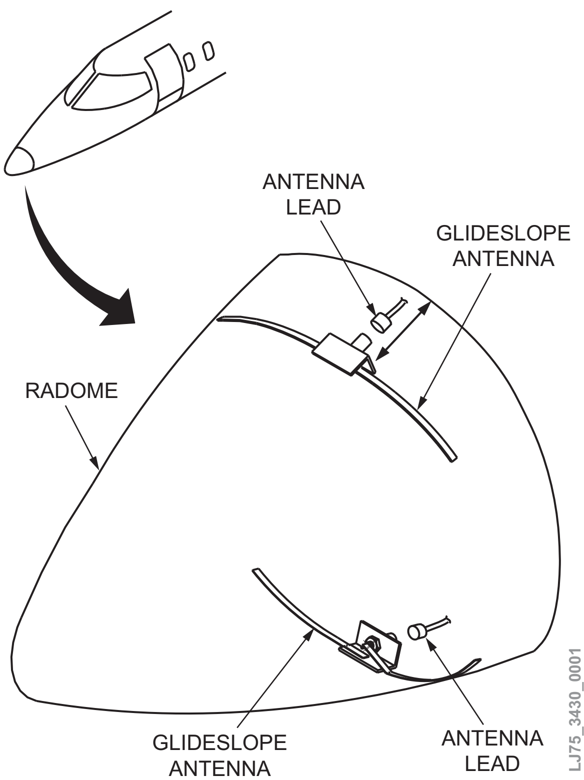


Fig. 42: Glideslope Antennas

Audio Processor Units

Figure 43

The marker beacon function is installed in the audio processor units located forward of the instrument panel.

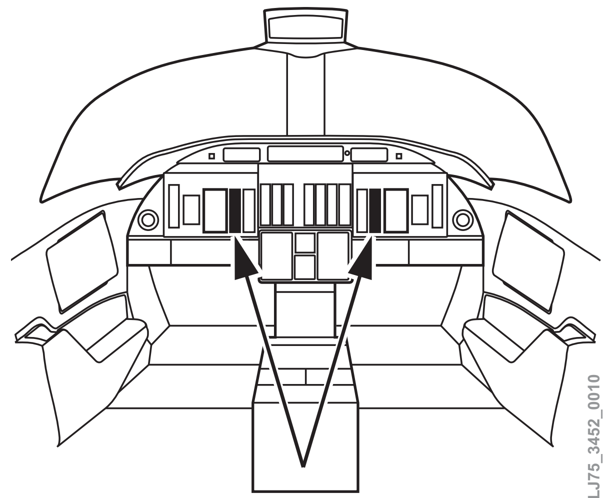


Fig. 43: Audio Processor Units

Marker Beacon Antenna

Figures 44

The marker beacon antenna is installed on the underside of the fuselage at FS163. The antenna receives signals from the marker beacon ground transmitters.

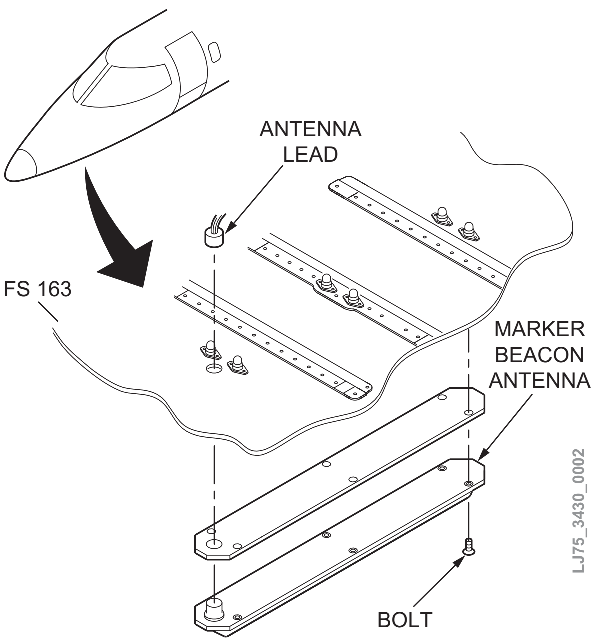


Fig. 44: Marker Beacon Antenna

Marker Beacon Splitter

Figures 45

The marker beacon splitter is installed behind DU1 on the LH side. The marker beacon antenna splitter receives the RF signal from the marker beacon antenna and distributes it to the two VHF navigation receivers to allow single antenna operation.

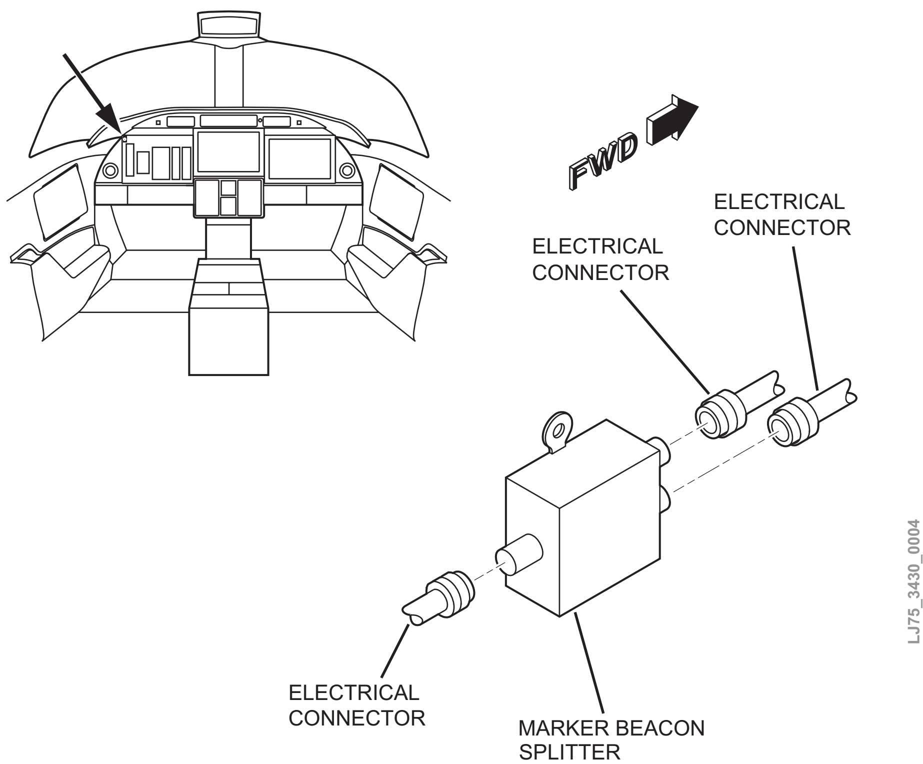


Fig. 45: Marker Beacon Antenna Splitter

Touch Controllers

Figure 46

NAV frequencies are selected through the touch controllers (GTC) with the Audio and Radios selection.

Selection and active frequencies are displayed on the PFDs as NAV1 and NAV2 in the top left corner.

Two bearing pointers are available on the PFD settings and are displayed on the HSI. They are selectable between NAV, GPS, or ADF.

The NAV1 function is displayed as a single line and NAV2 as a double line.

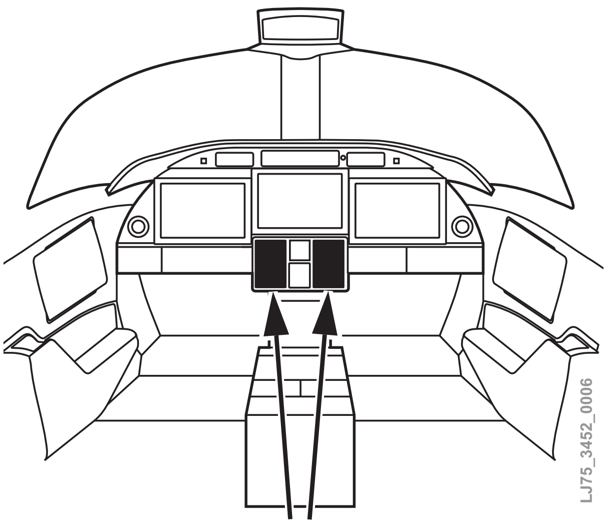


Fig. 46: Touch Controllers

Remote Controllers

Figure 47

The remote controllers on the glareshield perform inset map panning and ranging, and adjust barometric settings.

The COM/NAV button on the display controllers will display a window/page that allows the cursor to be moved onto the COM or NAV frequencies to edit them.

The COM/NAV page allows for editing the selected COM or NAV source, transferring standby to active frequency, selecting the microphone, and controlling volume.

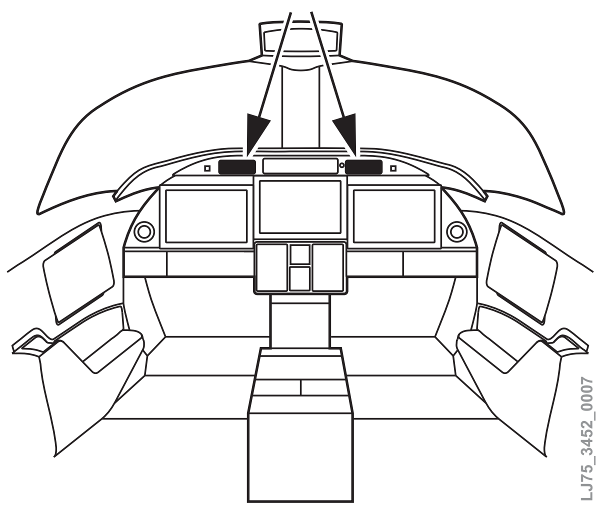


Fig. 47: Remote Controllers

Indications

Glideslope indications appear to the left of the altimeter when an ILS frequency is tuned in the active NAV field and the selected heading and course are within 107°.

- A green diamond acts as the glideslope indicator
- If there is no glideslope, “NO GS” is displayed instead of the diamond

Marker beacon annunciators are displayed as an “O” for outer, “M” for middle, or “I” for inner marker above the glideslope tape

The CDI can display course deviation from NAV (VOR/LOC) or from GPS.

The color of the CDI indicates the source:

- Green for NAV
- NAV1 is single lined
- NAV2 is double lined

SYSTEM OPERATION

Figure 48, 49, 50, and 51

VOR and Localizer Navigation

The VHF radios provide VOR and localizer (LOC) navigation capabilities. A VOR/LOC ground station broadcasts a VHF radio composite signal that includes the station identification and a navigation signal. The navigation signal is used to determine the magnetic bearing from the station that the aircraft is to or from.

An ILS consists of two independent sub-systems, one providing lateral guidance (localizer), the other vertical guidance (glideslope) to aircraft approaching a runway. The marker beacon system used in conjunction with ILS approaches gives the pilots both aural alerts and annunciations when flying over the outer, middle, and inner marker beacons.

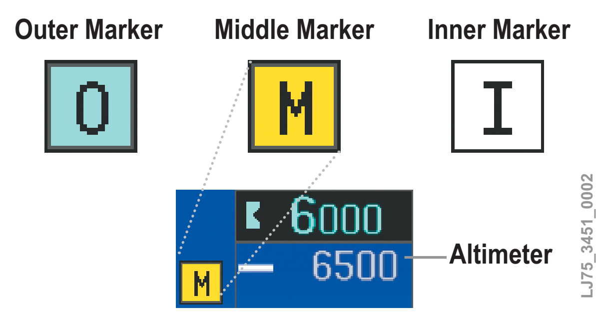


Fig. 48: Marker Beacon Annunciations

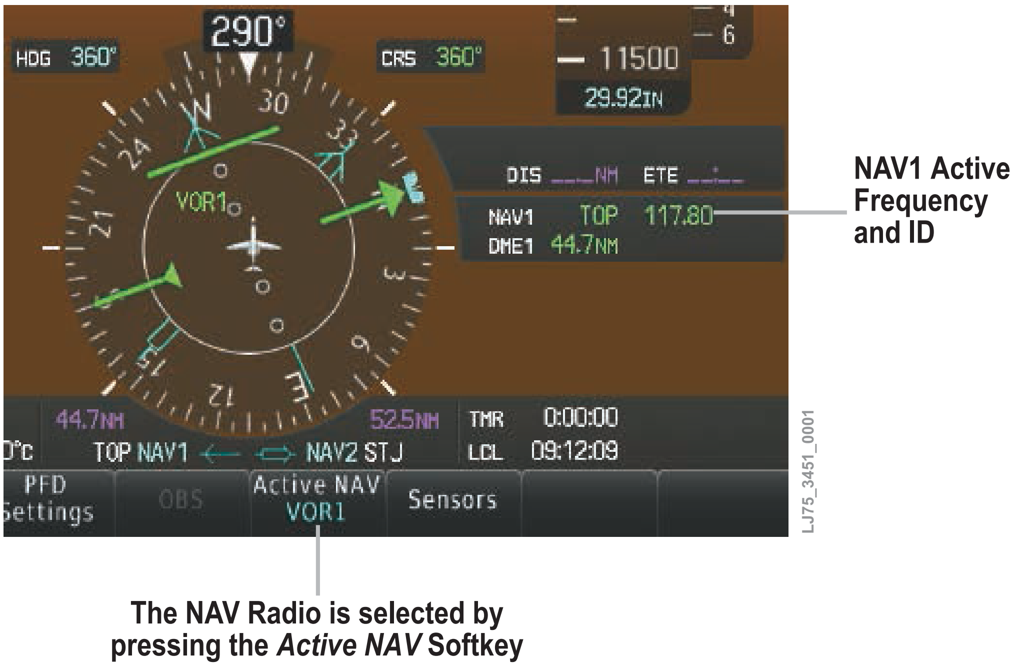


Fig. 49: Selecting a NAV Radio for Navigation

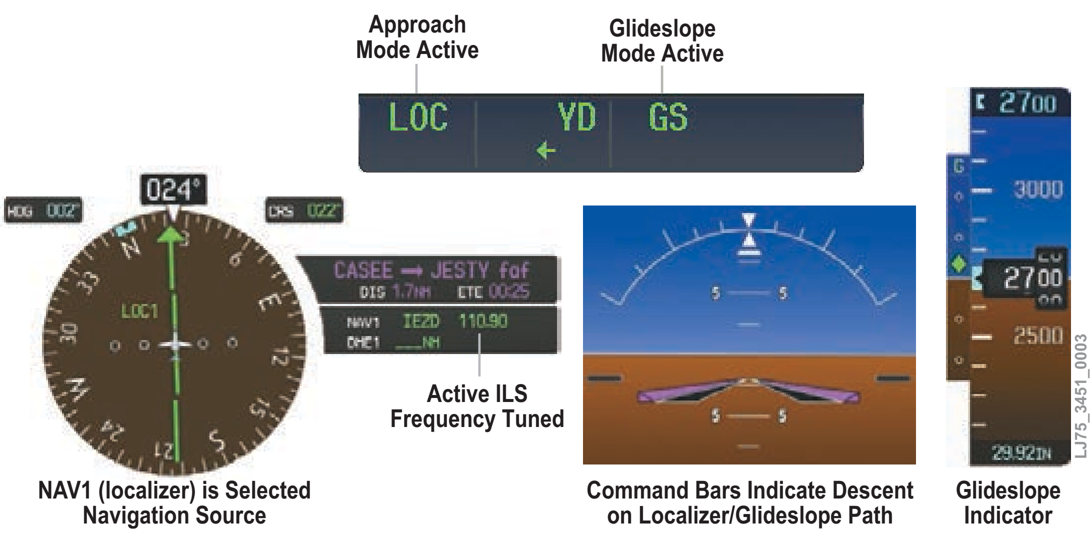


Fig. 50: Glideslope Mode

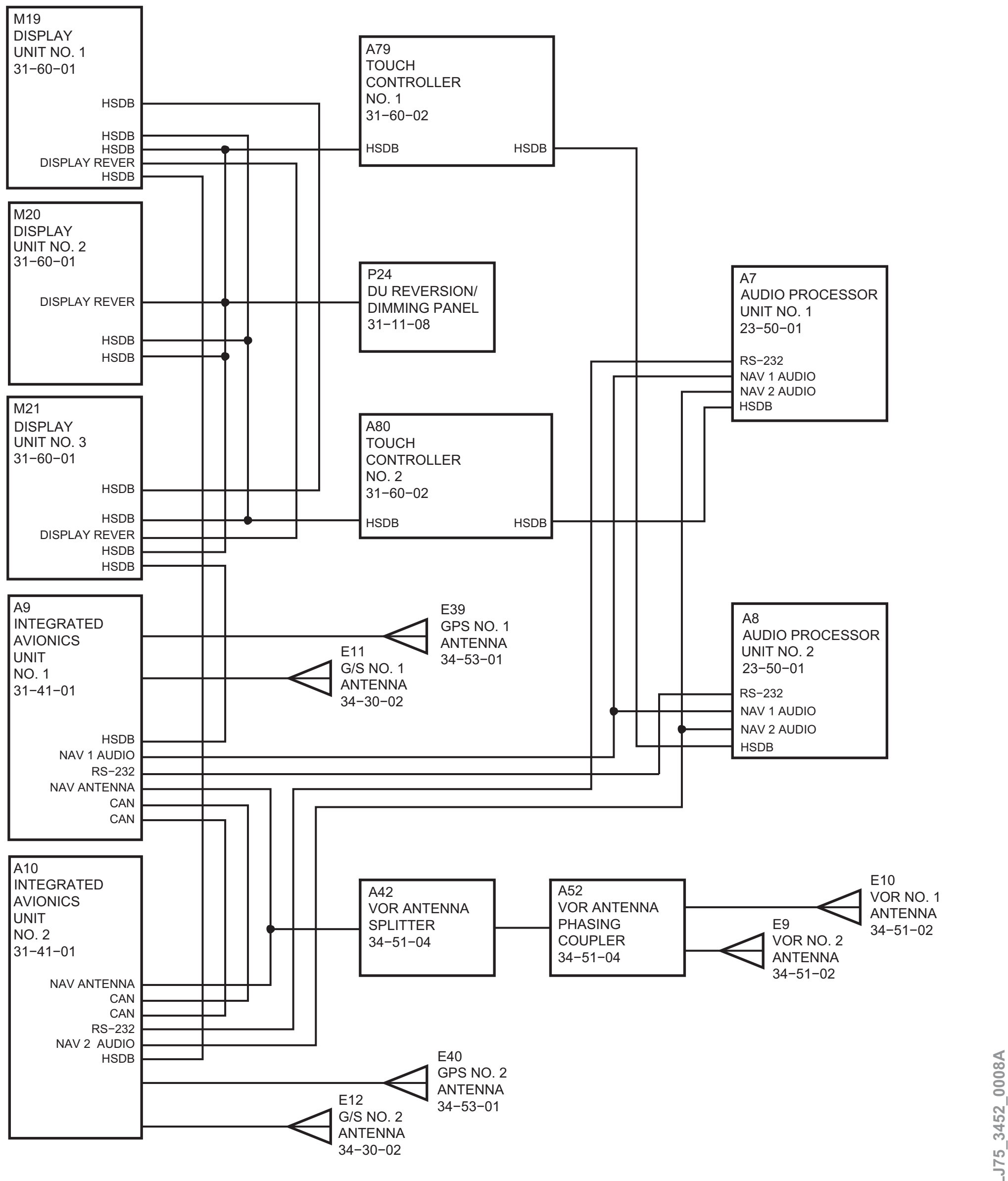


Fig. 51: VHF Block Diagram

Power

Figure 52

Primary power for NAV 1 is supplied through a circuit breaker on the left essential bus on the pilot circuit breaker panel.

Secondary power is supplied through a circuit breaker on the emergency battery bus on the pilot circuit breaker panel.

NAV 2 power is supplied through a circuit breaker on the right essential bus on the copilot circuit breaker panel.

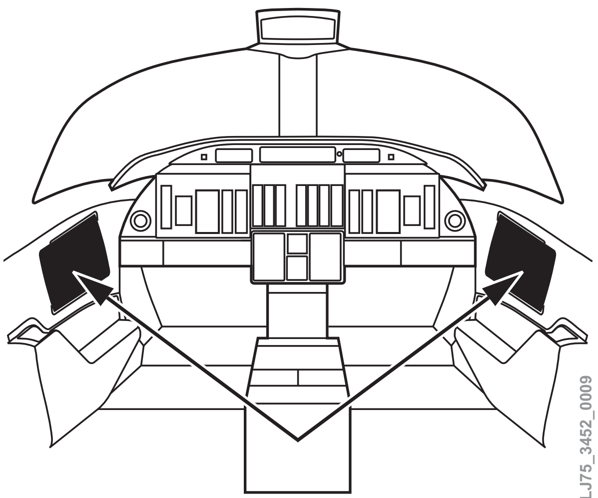


Fig. 52: NAV Power

FAULT INDICATIONS

Table 2: VHF Navigation System Messages

SYSTEM MESSAGE	DESCRIPTION	COMMENTS
NAV1 SERVICE	NAV1 needs service. Return unit for repair.	A failure has been detected in the NAV1 and/or NAV2 receiver. The receiver may still be available. The system should be serviced.
NAV2 SERVICE	NAV2 needs service. Return unit for repair.	
NAV1 RMT XFR	NAV1 remote transfer key is stuck.	The remote NAV1 and/or NAV2 transfer switch is stuck in the enabled (or pressed) state. Press the transfer switch again to cycle its operation. If the problem persists, the system should be serviced.
NAV2 RMT XFR	NAV2 remote transfer key is stuck.	
NAV1 MANIFEST	NAV1 software mismatch. Communication halted.	The NAV1 and/or NAV2 has incorrect software installed. The system should be serviced.
NAV2 MANIFEST	NAV2 software mismatch. Communication halted.	
G/S1 FAIL	G/S1 is inoperative.	A failure has been detected in glideslope receiver 1 and/or receiver 2. The system should be serviced.
G/S2 FAIL	G/S2 is inoperative.	
G/S1 SERVICE	G/S1 needs service. Return unit for repair.	A failure has been detected in glideslope receiver 1 and/or receiver 2. The receiver may still be available. The system should be serviced when possible.
G/S2 SERVICE	G/S2 needs service. Return unit for repair.	

This page intentionally left blank

GLOBAL POSITIONING SYSTEM

(ATA 34-53-00)

OVERVIEW

The global positioning system (GPS) provides real-time and predictive receiver autonomous integrity monitoring (RAIM) and fault detection and exclusion (FDE) information. The GPS selects the best positioned satellites for those visible, and, using their signals, determines ranges to the used satellites.

These ranges are converted to a three-dimensional position to determine velocity. The position information is also converted to latitude, longitude, and altitude information.

COMPONENTS

The global positioning system (GPS) consists of:

- GPS antennas

ASSOCIATED COMPONENTS

- Integrated avionic units (2)
- Touch controllers (2)
- Display units (2)

COMPONENT DESCRIPTION

Integrated Avionics Units (GPS Module)

The GPS module is an internal part of the integrated avionics units. Each integrated avionics unit houses a 15-channel, WAAS-certified, GPS receiver capable of tracking up to 12 GPS satellites and three GPS/satellite-based augmentation system (SBAS) satellites simultaneously.

The GPS receiver has the ability to determine its position within 12 minutes maximum from the time power is applied to the unit.

GPS Antennas

Figure 53

The GPS antennas are located on top of the aircraft at FS260.

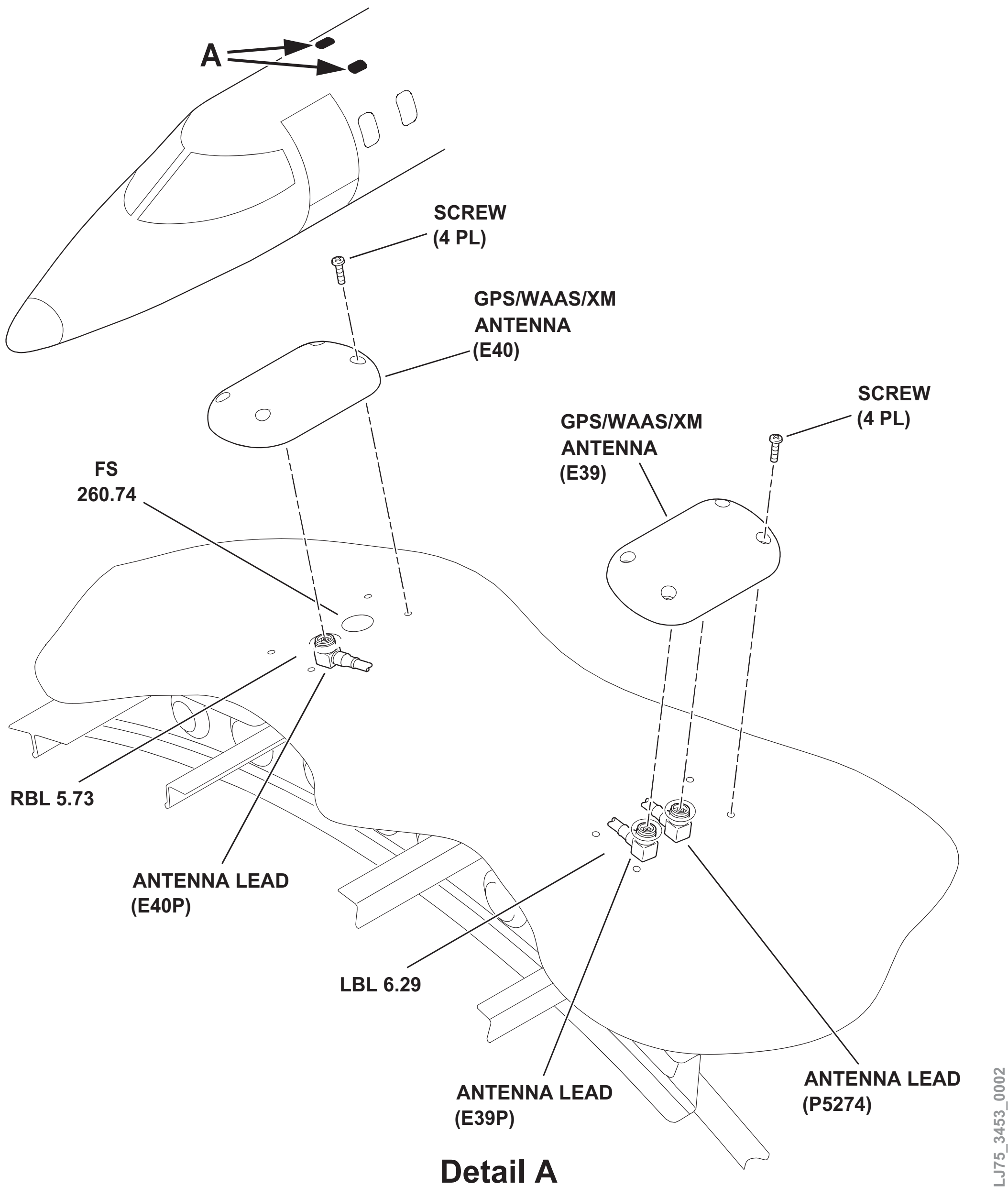


Fig. 53: GPS/WAAS/XM Antenna – Removal/Installation

SYSTEM OPERATION

Figure 54

AHRS

The attitude and heading reference system (AHRS) uses GPS in its primary mode, no-magnetometer, and no-magnetometer-no-air data modes of operation. GPS 3D velocity is used in algorithms to help the AHRS determine attitude and heading solution, and when taxiing (on ground) and when not turning to determine heading, whether magnetic field data is valid or not.

GPS 3D position is used to verify that the magnetic field reported by the magnetometer is consistent with the current location in the international geometric reference field.

To determine the AHRS is operating within latitude extremes in which magnetic field measurements can be used reliably.

EICAS

EICAS “in air” and “on ground” statuses are determined by the weight-on-wheels input discrete signals, with GPS ground speed and TAS considered as backup options. GPS altitude may be used in determining landing and takeoff inhibits.

GPS pulse per second is used to synchronize the flashing of the pilot master warning indicator, with the copilot master warning (integrated avionics unit no. 1 drives the pilot, and integrated avionics unit no. 2 drives the copilot.)

GPS is also used to synchronize the onscreen cursor blinking with the master warning outputs. In addition to coupling to GPS flight plans and approaches, the flight director and autopilot use GPS to augment various other flight director modes. For example, “distance to station” is GPS-derived.

Indications

GPS quantities are displayed on the PFD or in reversionary mode as follows:

- GPS ground track and ground speed are used to determine the horizontal wind vector, which is shown near the compass card
- Time displayed in the lower-right corner of the PFD is updated using GPS
- A magenta diamond on the HSI indicates GPS track
- GPS is used to display course pointer and course deviation when in GPS mode
- The bearing information (GPS, NAV1, or NAV2 selected) shows distance information derived from GPS
- GPS horizontal position is used to determine nearest airports
- The frame of reference for perspective depiction of surrounding terrain, runways, large bodies of water, obstacles, and terrain warnings is GPS-derived latitude, longitude, and geoidal altitude

Displays

GPS quantities displayed on the MFD are as follows:

- Aircraft horizontal location on the moving map is depicted based on GPS position
- GPS horizontal position used to properly geo-reference:
  - Map
  - Traffic weather
  - Terrain
  - TAWS data
- GPS ground track and ground speed are used to determine the horizontal wind vector
- The GIFD requires a valid 3D position solution in its TAWS algorithms
- Aircraft lateral/horizontal location on the map is depicted based on GPS position when the aircraft is within the view of the map
- Trip statistics, odometer, trip average ground speed, maximum ground speed, are derived from GPS
- Date and time displayed is updated using GPS
- GPS horizontal position is used to determine nearest airports, intersections, NDBs, VORs, user waypoints, frequencies, and airspaces
- GPS horizontal position is used to display aircraft position on charts

Control

The touch controllers are used to control the GPS system.

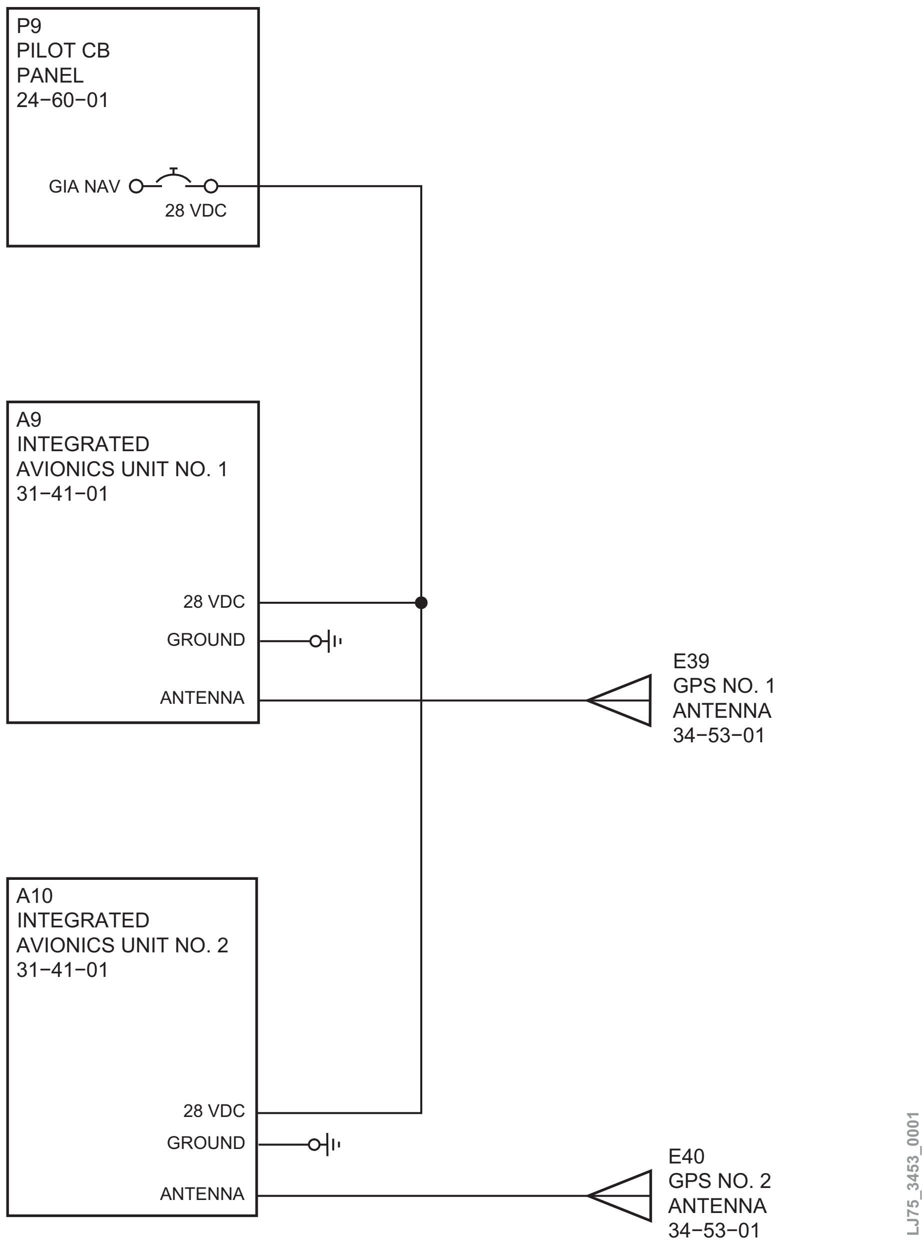


Fig. 54: GPS Block Diagram

FAULT INDICATION

Table 3: GPS System Messages

SYSTEM MESSAGE	DESCRIPTION	COMMENTS
LOI	GPS integrity lost. Crosscheck with other NAVs.	GPS integrity is insufficient for the current phase of flight.
GPS NAV LOST	Loss of GPS navigation. Insufficient satellites.	Loss of GPS navigation due to insufficient satellite coverage.
GPS NAV LOST	Loss of GPS navigation. Position error.	Loss of GPS navigation due to position error.
GPS NAV LOST	Loss of GPS navigation. GPS fail.	Loss of GPS navigation due to GPS failure.
ABORT APR	Loss of GPS navigation. Abort approach.	Abort approach due to loss of GPS navigation.
APR DWNGRADE	APR downgraded.	Vertical guidance generated by SBAS is unavailable. Use only LNAV minimums.
TRUE APR	True north approach. Change HDG reference to true.	Displayed after passing the first waypoint of a true north approach when the NAV angle is set to AUTO.
RAIM UNAVAIL	RAIM is not available from FAF to MAP waypoints.	GPS satellite coverage is insufficient to perform Receiver Autonomous Integrity Monitoring (RAIM) from the FAF to MAP waypoints.
GPS1 SERVICE	GPS1 needs service. Return unit for repair.	A failure has been detected in the GPS1 and/or GPS2 receiver 1 and/or receiver 2. The receiver may still be available. The system should be serviced.
GPS2 SERVICE	GPS2 needs service. Return unit for repair.	
GPS1 FAIL	GPS1 is inoperative.	A failure has been detected in the GPS receiver No.1 and/or GPS receiver No.2. The system should be serviced.
GPS2 FAIL	GPS2 is inoperative.	

DISTANCE MEASURING EQUIPMENT (DME) SYSTEM

(ATA 34-55-00)

OVERVIEW

The DME system shows the direct line distance between the aircraft and a ground station. The aircraft systems use DME data to determine the aircraft position, find vertical separation, find the approach to an airport, keep the aircraft out of protected airspace, hold the aircraft in position, and calculate the ground speed. The baseline aircraft configuration includes a dual DME system.

COMPONENTS

- DME transceivers (2)
- DME antennas (2)

ASSOCIATED COMPONENTS

- Touch controllers (2)
- Data concentrators (2)
- Audio processors (2)

COMPONENT DESCRIPTION AND OPERATION

DME Transceivers

Figure 55

The primary DME unit is located in the left avionics nose compartment. DME 2 is located in the right avionics nose compartment.

The DME transceiver is a fully solid-state device. It finds, calculates, and shows the distance between the aircraft and ground station. The DME transceiver can monitor three ground stations at the same time.

The DME transceiver operates in the frequency range of 960 to 1215 MHz. There are 252 DME frequency channels related to VHF navigation frequency channels. These VHF frequency channels are in the VHF navigation frequency range of 108.00 to 117.95 MHz.

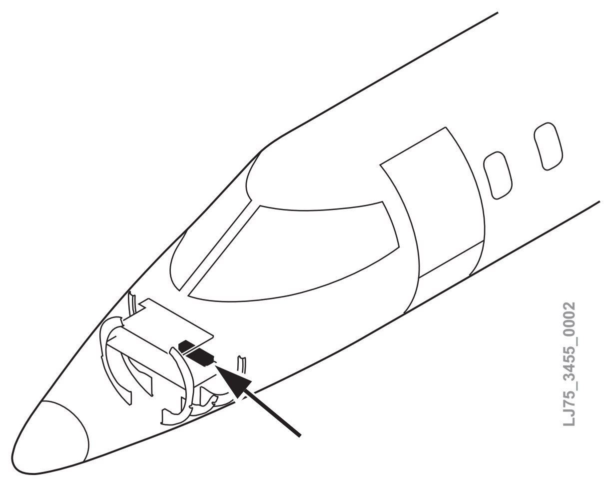


Fig. 55: DME Unit

DME Antenna

Figure 56

The DME antennas are located on the bottom of the aircraft.

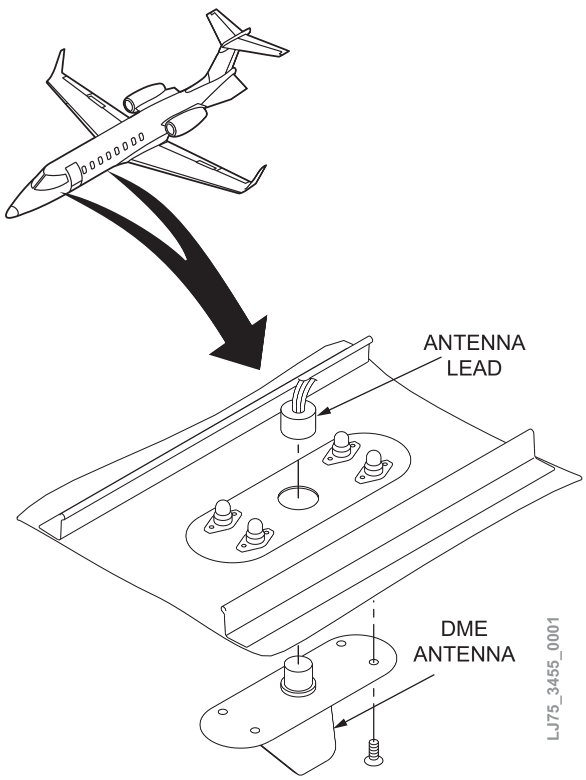


Fig. 56: DME Antenna

SYSTEM OPERATION

Figure 57

Power to the DME system is through the DME circuit breaker on the left essential bus. The DME simultaneously tracks four channels for distance, groundspeed, and time-to-station. It also tracks an additional two channels for the IDENT function.

The DME dedicates two of the tracking channels for the flight management system.

The crew may control and display IDENT, distance, time to station, and groundspeed from the other two channels. The two IDENT-only channels have decoded IDENT-ready so that when the crew selects the preset VOR channel. The instant search capability of its DME will allow the function for the four full-time channels.

The ranging capability of the DME is up to 300 miles, the groundspeed capability up to 1000 kt, and the time-to-station capability up to 300 miles. These signals are sent from the DME unit to the data concentrator and also the audio control units. Information is then sent to the DUs via HSDB.

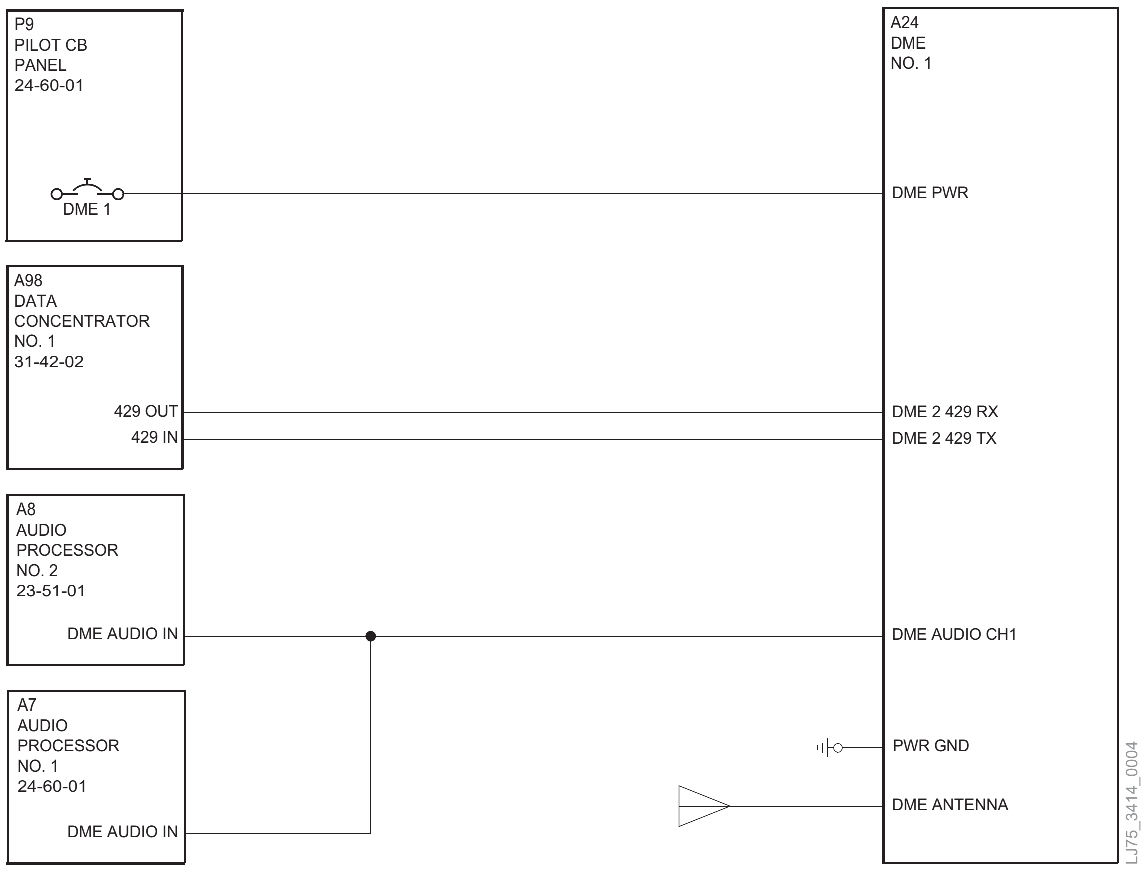


Fig. 57: Distance Measuring Equipment Block Diagram (1 of 2)

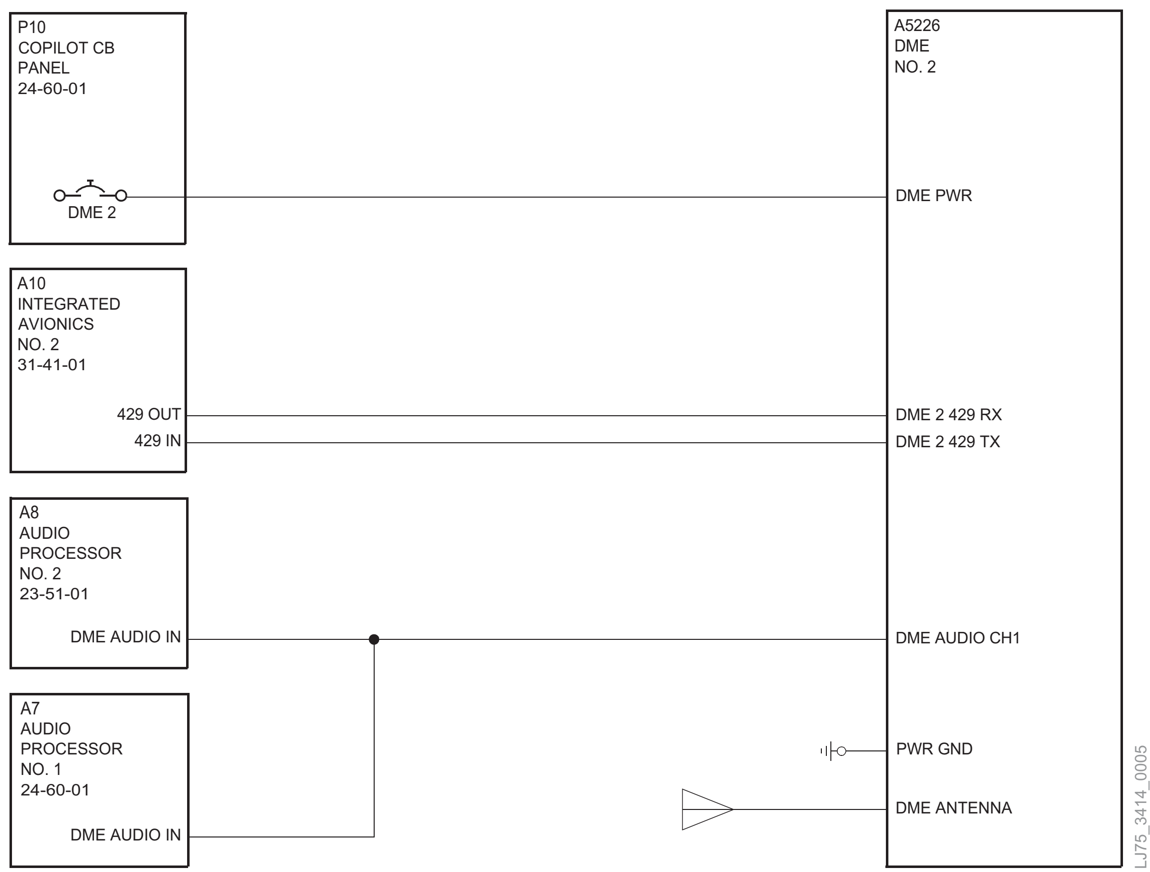


Fig. 57: Distance Measuring Equipment Block Diagram (2 of 2)

FAULT INDICATION

Figure 58

Fig. 58: DME Inop

ATC TRANSPONDER SYSTEM

(ATA 34-56-00)

OVERVIEW

The air traffic control (ATC) transponder system consists of a dual mode select type (mode S) transponder system. The mode S transponder system supplies the ATC radar-beacon system (ATCRBS) ground stations or traffic alert and collision avoidance system (TCAS) equipped aircraft with aircraft identification and altitude data in response to an interrogation signal. Only one transponder can operate at a time.

The ATCRBS is a surveillance system that monitors the aircraft location and identification data in an airspace. The information received by the ground station is shown on the ground controller air-traffic screen.

The interrogations sent by the ground station or by a TCAS equipped aircraft are at a frequency of 1030 MHz. The ATC transponder sends replies at a frequency of 1090 MHz. The interrogation and reply signals are pulse-coded type.

The ATC transponders are used in conjunction with the TCAS system to interrogate the transponders of other aircraft and monitor their replies. This permits the TCAS to track and supply traffic advisories and resolution advisories to the pilot and copilot to provide aircraft separation-assurance (ASA) functions.

COMPONENTS

Figure 59

The ATC transponder system includes the components that follow:

- ATC (mode S) transponders (2)
- ATC L-band antennas (4)
- ATC ident switches (2)

ASSOCIATED COMPONENTS

- Touch controllers (2)
- Integrated avionics units (2)

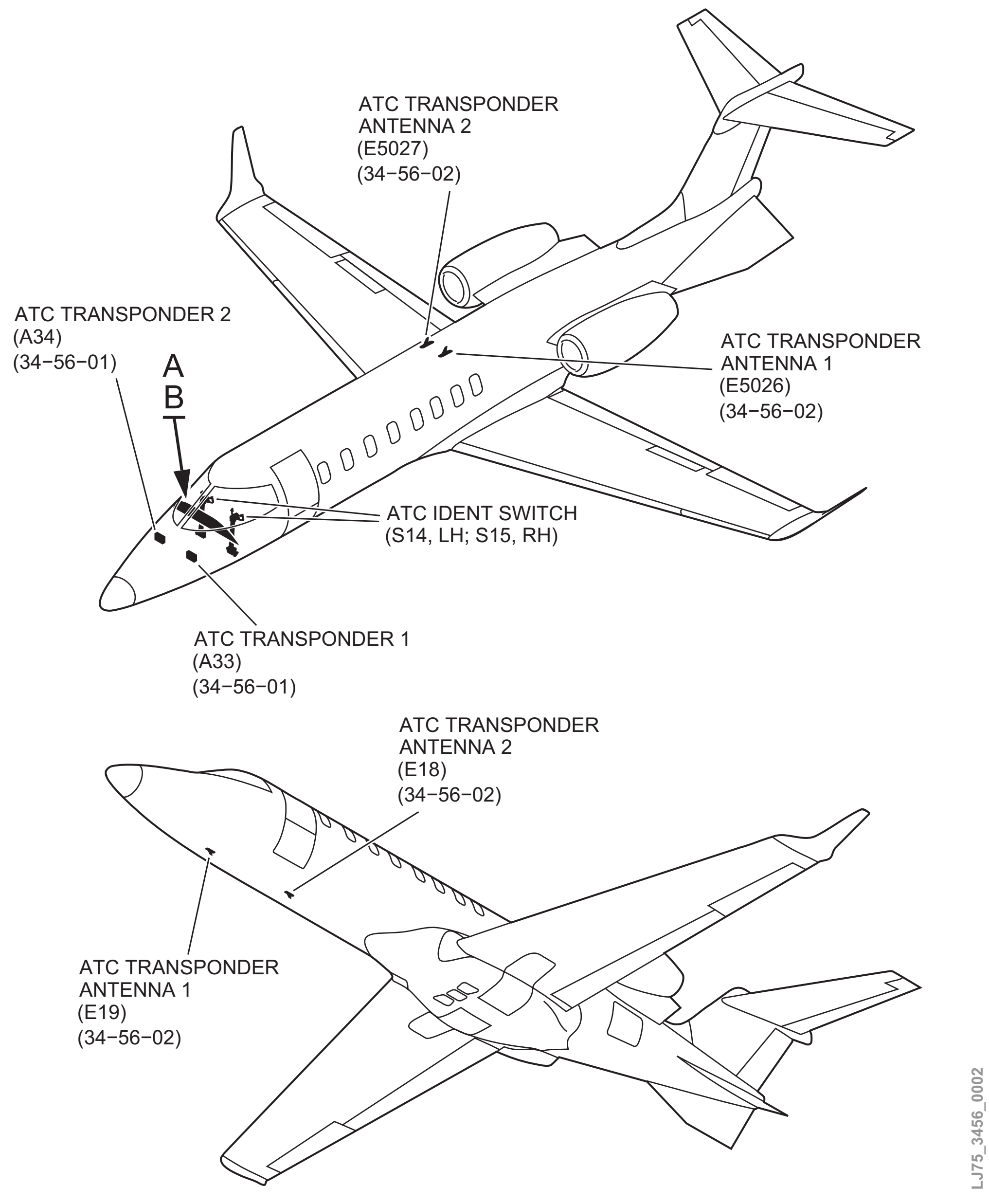


Fig. 59: ATC Transponder System

COMPONENT DESCRIPTION

ATC Transponders

Figure 60

The ATC transponders are solid-state components. Each transponder operates as a normal ATCRBS transponder, but also has the capability to send an aircraft specific identification code (mode S). This gives the transponder the capability to receive dedicated interrogation signals from the ground station or from a TCAS-equipped aircraft.

The ATC transponders operate in standby mode, mode A, mode C, and mode S.

- In standby mode, the transponder receives interrogation signals, but cannot send replies
- In mode A, the reply signal includes the aircraft ATC identification-code
- In mode C, the reply signal also includes the aircraft altitude
- In mode S, in addition to the ATC identification code and the aircraft altitude, the reply signal includes the international civil aviation organization (ICAO) code assigned to the aircraft (via configuration strapping), or the flight identification code

The mode S transponder 1 is installed in the nose compartment at FS140 LH. The mode S transponder 2 is installed in the nose compartment at FS140 RH.

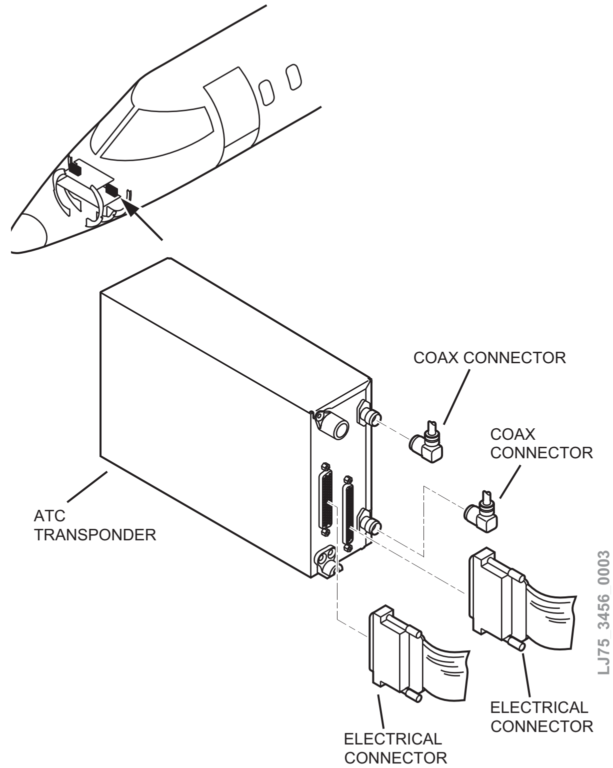


Fig. 60: ATC Transponder

ATC L-Band Antennas (ATC1, ATC2)

Figure 61

The four ATC L-band antennas are omnidirectional and identical. The antenna diversity-type of installation is used. For each ATC 1 and ATC 2 system, one antenna is installed on the top of the fuselage and the other on the bottom. Diversity antenna installation prevents shadow or blockage of the radiation pattern with other aircraft or the ground radar, and provides better performance during aircraft maneuvers.

The upper ATC 1 antenna is installed on the top of fuselage. The lower ATC 1 antenna is installed on the bottom of fuselage at center line. The upper ATC 2 antenna is installed on the top of fuselage. The lower ATC 2 antenna is installed on the bottom of fuselage at center line.

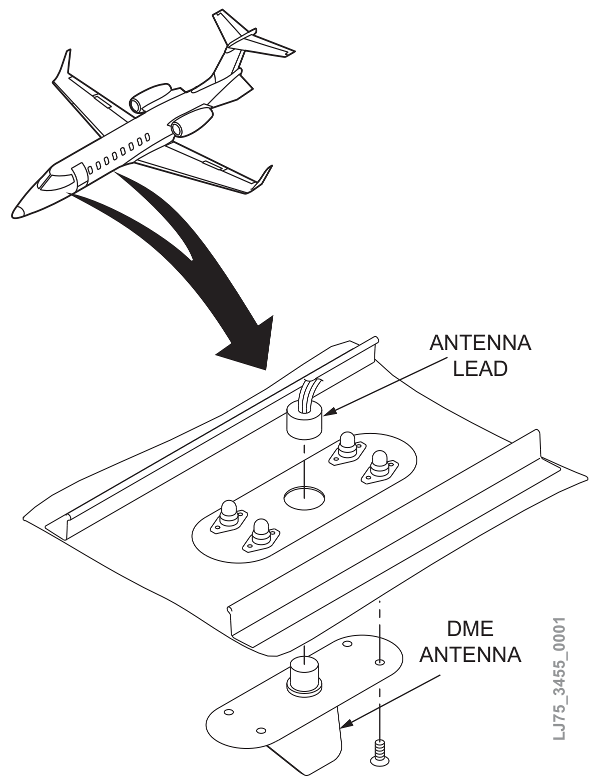


Fig. 61: ATC Antenna

ATC Ident Switches

Figure 62

When the pilot or copilot ATC ident switch is pushed on the related control wheel, a distinct identity indication is sent to the ATC ground station. An IDENT indication also shows on the GTCs. This function is for the ground station to distinguish the identifying aircraft from all others that appear on their air traffic screen.

The pilot ATC ident switch is installed on the pilot control wheel. The copilot ATC ident switch is installed on the copilot control wheel.

NOTE

In standby mode, the XPDR IDENT button is inoperative.

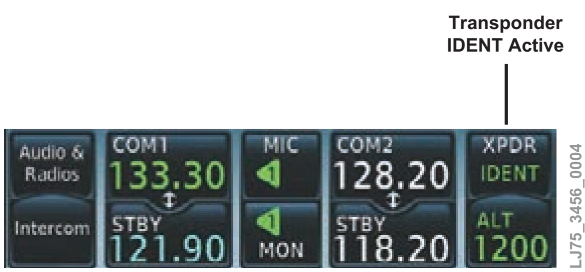


Fig. 62: Transponder IDENT Indication

Touch Controllers (GTC1, GTC2)

Figure 63

The GTC 1 and GTC 2 provide control and display of the ATC functions. Controls are provided via the GTC Transponder page. Displays are provided on the GTC radio bar (radio page) and on the GTC Transponder page.

GTC 1 and GTC 2 are installed below the DU 2 on the tilt panel.

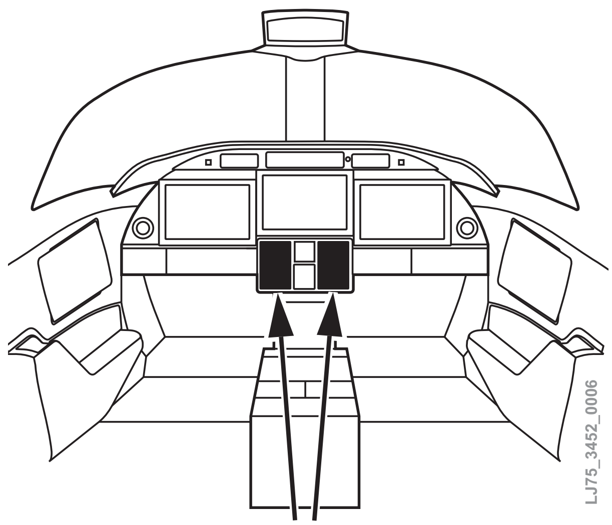


Fig. 63: Touch Controller

Integrated Avionics Units

Figure 64

The two integrated avionics units are microprocessor-based input/output LRUs that communicate with the ATC transponders via RS-422 databus. They also communicate with the DUs via HSDB for configuration control. A CAN bus connection provides communication between the two integrated avionics units to support data availability in the event of either integrated avionics unit failure.

Integrated avionics unit 1 is installed forward of DU1. Integrated avionics unit 2 is installed forward of DU3.

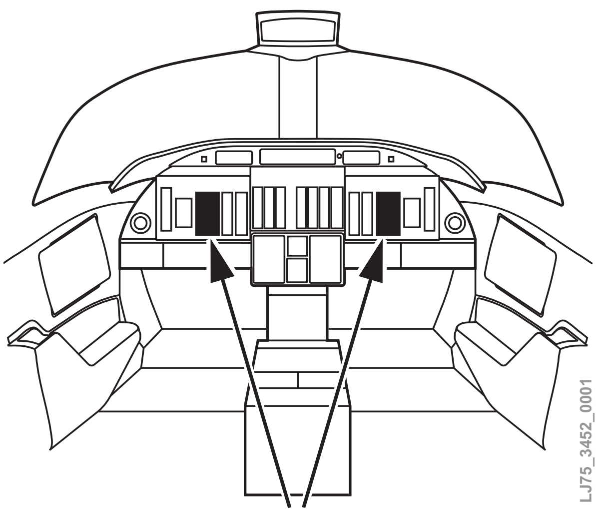


Fig. 64: Integrated Avionics Units

CONTROLS AND INDICATIONS

Control and display of the ATC transponders are done through the GTCs.

The GTCs show the displays that follow:

- Selected ATC transponder XPDR 1 or XPDR 2
- ATC mode selected
- ATC code selected
- IDENT indication when activated
- Reported altitude display
- Indication during ATC reply

The GTCs provide the following controls:

- Transponder code entry (including VFR)
- Active transponder 1 or 2 selection
- ATC mode (on, standby, altitude reporting, ground) selection
- Transponder ident activation (could also be done via the ATC ident switch on the pilot and copilot control wheels)
- Flight ID code entry
- Test initiation

SYSTEM OPERATION

General

The ATC transponders provide mode A, C, and mode S interrogation and reply capabilities. The mode S is always active (acquisition squitter). The mode S capability permits the ground controller or a TCAS-equipped aircraft in the vicinity to send interrogation signals to the aircraft of immediate interest. The active on-board ATC (mode S) transponder sends replies to the mode S ATCRBS and TCAS interrogations. No operator action is necessary.

When the ATC transponder system is selected on, the system defaults to the transponder active prior to shutdown. The ATC identification code and mode remain the same even though a switch is done between transponders 1 and 2. If a new code is set for the active transponder, switching the transponders does not bring back the previous code.

Standby Mode

The standby mode can be selected at any time. In standby mode, the transponder does not reply to interrogations, but new codes can be entered.

ON Mode

The ON mode can be selected at any time. The ON mode generates mode A replies but mode C altitude reporting is inhibited. Mode A replies include the ATC identification code, which can be set from 0000 to 7777 (digits 0 to 7 only).

Emergency codes 7500, 7600, and 7700 are not to be used in normal operation. The acquisition squitter is also active.

Altitude Reporting Mode

The altitude reporting mode is automatically selected when the aircraft becomes airborne. Altitude reporting mode may also be selected manually via the GTC Transponder page. Altitude reporting mode generates mode A and mode C replies. The acquisition squitter is also active.

Ground Mode

The ground mode is automatically selected when the aircraft is on the ground. The ground mode can be overridden by selecting any other mode. In ground mode, the transponder does not allow mode A and mode C replies, but it does permit acquisition squitter and replies to discretely addressed mode S interrogations.

Flight ID

With the flight identification (flight ID) function, the mode S transponder reports the aircraft identification as either the aircraft registration or a unique flight ID code. The flight ID can be entered by the crew via the GTCs or hard-coded by the installer.

Acquisition Squitter

The acquisition squitter, or short squitter, is the transponder 24-bit identification address code (ICAO) set via configuration strapping at initial system installation. This identification code is unique and permits an interrogation to be sent to a specific aircraft.

The acquisition squitter transmission is sent periodically, regardless of the presence of interrogations. The purpose of the acquisition squitter is to continuously enable ground stations and aircraft equipped with TCAS to recognize the presence of mode S-equipped aircraft for selective interrogation.

Extended Squitter

The extended squitter is a function part of the TCAS processor, which transmits the ADS-B information. The ADS-B enhances safety by making an aircraft visible, real-time, to ATC and to other appropriately equipped ADS-B aircraft with position, velocity, and heading data transmitted every second.

TCAS Interface

The mode S transponders have the data link capability that permits the TCAS-equipped aircraft to do air traffic control and aircraft separation-assurance (ASA) functions. The TCAS includes an interrogator processor unit, which provides, along with the mode S transponders, air-to-air traffic data link. The TCAS uses interrogations from the active ATC transponder to provide traffic advisories to the flight crew independent of the air traffic control system. The TCAS interfaces with the two mode S transponders via ARINC 429 data buses. Refer to the TCAS section (34-44-00) for more information on the TCAS operation.

Suppression Signal

Only one of the units that follow can transmit at a time.

If one of the ATC transponders transmits, a suppression signal is sent to the units that follow:

- TCAS processor
- Distance measuring equipment (DME) transceiver 1
- DME transceiver 2 (optional)
- Remaining ATC transponder

Power

Figure 65

ATC transponder 1 is energized via the ATC 1 circuit breaker from the left essential bus on the pilot circuit breaker panel.

ATC transponder 2 is energized via the ATC 2 circuit breaker from the right main avionics bus on the copilot circuit breaker panel.

Touch controller GTC 1 is energized via the GTC 1 circuit breaker from the emergency battery bus on the pilot circuit breaker panel.

Touch controller GTC 2 is energized via the GTC 2 circuit breaker from the right essential bus on the copilot circuit breaker panel.

Integrated avionics unit 1 is energized via the GIA NAV PRI circuit breaker (through the cockpit miscellaneous relay panel (P11) from the left essential bus and via the GIA NAV SEC circuit breaker from the emergency battery bus both on the pilot circuit breaker panel.

Integrated avionics unit 2 is energized via the GIA 2 MAIN circuit breaker from the right essential bus on the copilot circuit breaker panel.

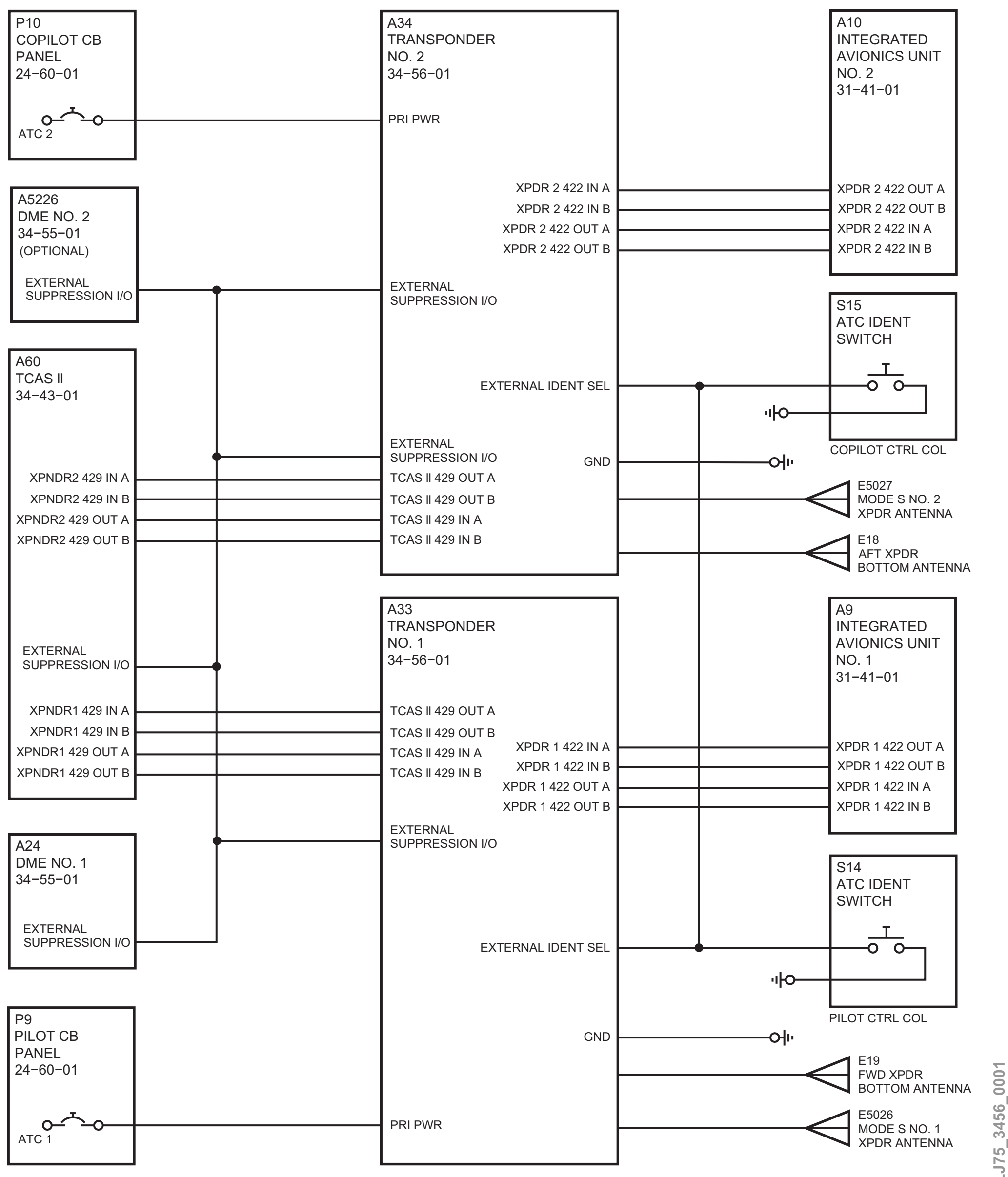


Fig. 65: ATC Transponder System Block Diagram

FAULT INDICATION

Table 4: ATC Transponder System – CAS Messages

CAS MESSAGE	LOGIC
ATC 1 FAULT	At least one of the GTX1 system messages has been triggered
ATC 2 FAULT	At least one of the GTX2 system messages has been triggered
ATC 1-2 FAULT	At least one of the GTX1 and GTX2 system messages has been triggered

AUTOMATIC DIRECTION FINDER (ADF) SYSTEM

(ATA 34-57-00)

OVERVIEW

The automatic direction finder (ADF) system is a dual low-frequency radio system. The ADF system is used to indicate the bearing to a selected ground station.

COMPONENTS

The ADF system consists of:

- ADF receivers (optional) (2)
- ADF antenna

ASSOCIATED COMPONENTS

- Touch controllers (2)
- Data concentrators (2)
- Audio processors (2)

COMPONENT DESCRIPTION

ADF Receivers

Figure 66

The ADF receivers (right primary, left secondary) are located in the aft nose avionics compartment. The primary unit is located on the right side and the secondary is located on the left side.

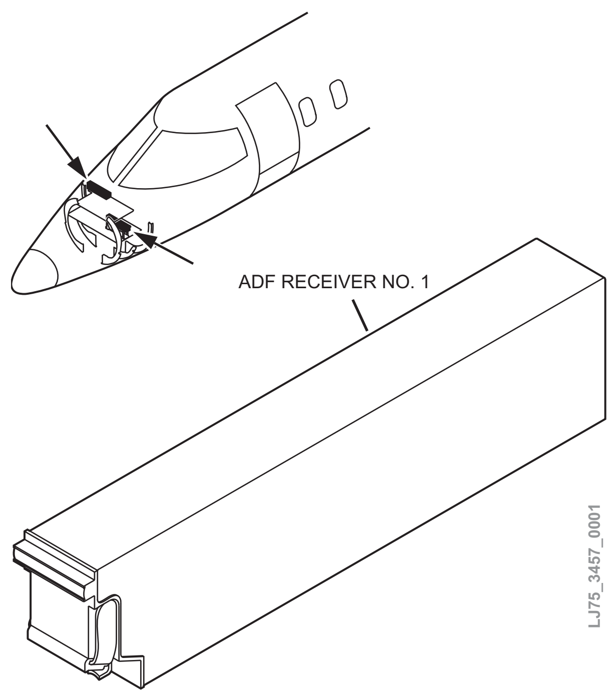


Fig. 66: Automatic Direction Finder Units

ADF Antenna

Figure 67

The ADF antenna is a dual-element antenna. A second ADF antenna is no longer installed when the aircraft is configured for the optional dual ADF.

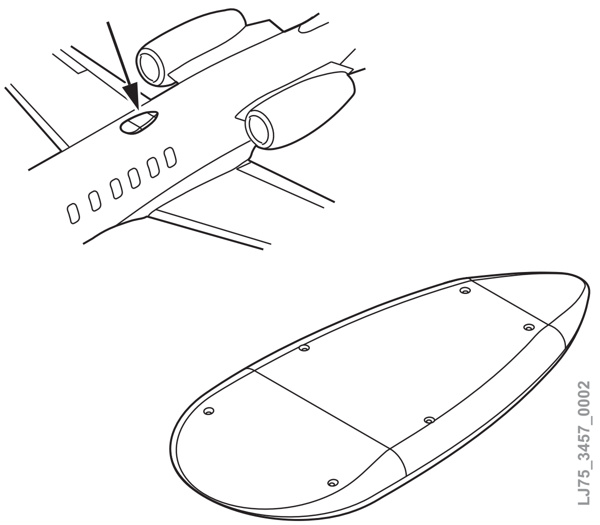


Fig. 67: ADF Antenna

SYSTEM DESCRIPTION

The ADF system is a navigational aid used to give the crew continuous relative bearing indications to low-frequency homing stations, radio beacon, and broadcast stations.

SYSTEM OPERATION

Figure 68 and 69

The ADF system antenna receives signals in the frequency range of 100 kHz to 1799.5 kHz and gives the signals to the ADF receiver. The primary receiver processes the signals into sound and bearing data. Sound data is heard through the speaker system or headphones via the audio processors, and bearing data is controlled and displayed on the GTCs via the data concentrators.

Control

Control of the ADF system is provided by the touch controllers. From the Audio & Radios screen the following modes can be selected:

- ANT (Antenna)—ADF bearing pointer parks on the HSI at 90°. Best mode for listening to NDB audio.
- ADF (Automatic Direction Finder)—ADF pointer points to the relative bearing of the NDB station.
- ADF/BFO (ADF/Beat Frequency Oscillator)—ADF pointer points to the relative bearing of the NDB station and an audible tone confirms signal reception. This mode allows identification of the interrupted carrier beacon stations used in various parts of the world.
- ANT/BFO (Antenna/Beat Frequency Oscillator)—ADF bearing pointer parks on the HSI at 90° while an audible tone is provided when a signal is received. This mode also allows identification of the interrupted carrier beacon stations and confirms signal reception.

Power

Primary power to the ADF system is provided by the ADF 1 circuit breaker on the pilot circuit breaker panel via the left MAIN avionics bus. Secondary power to the ADF system is provided by the ADF 2 circuit breaker panel via the right essential avionics bus.

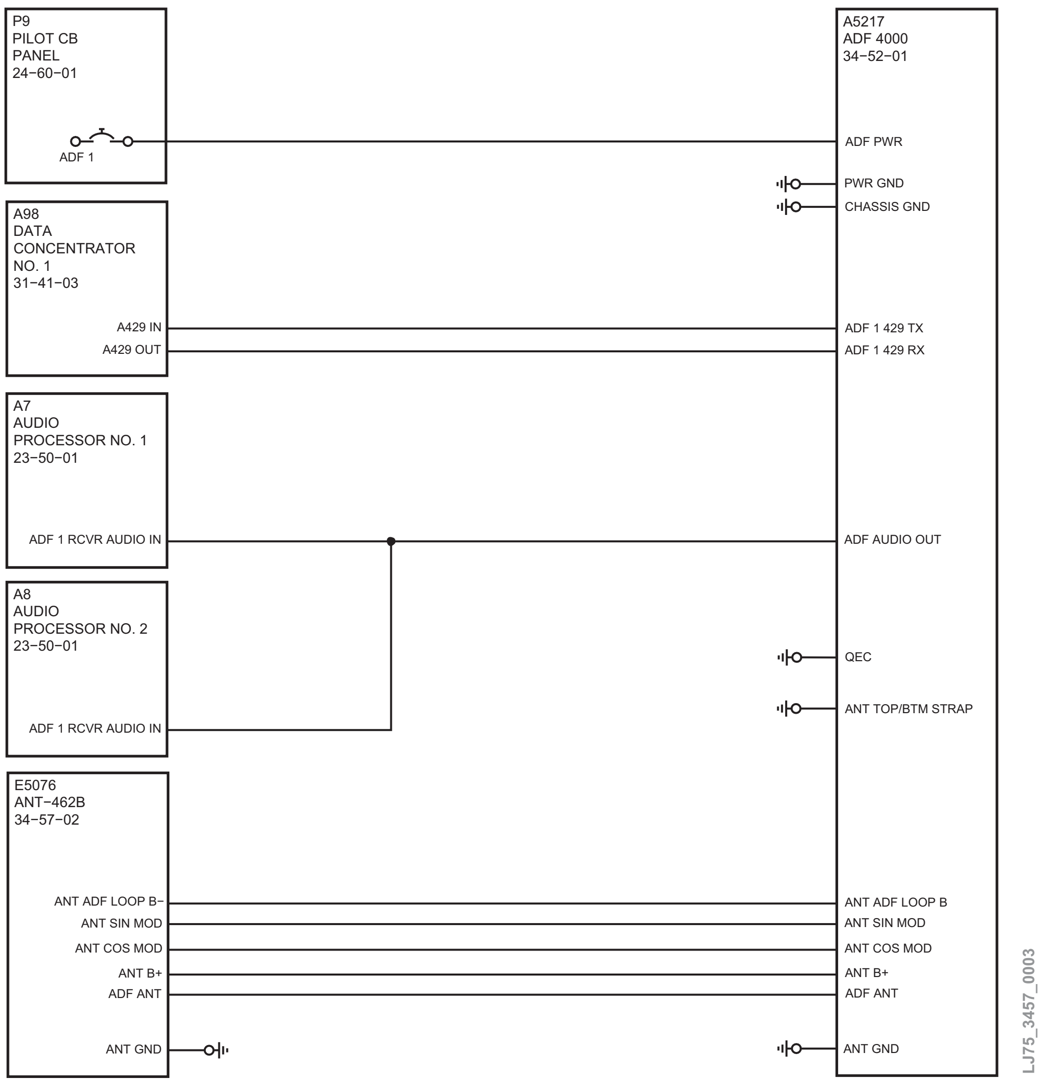


Fig. 68: ADF System Block Diagram (1 of 2)

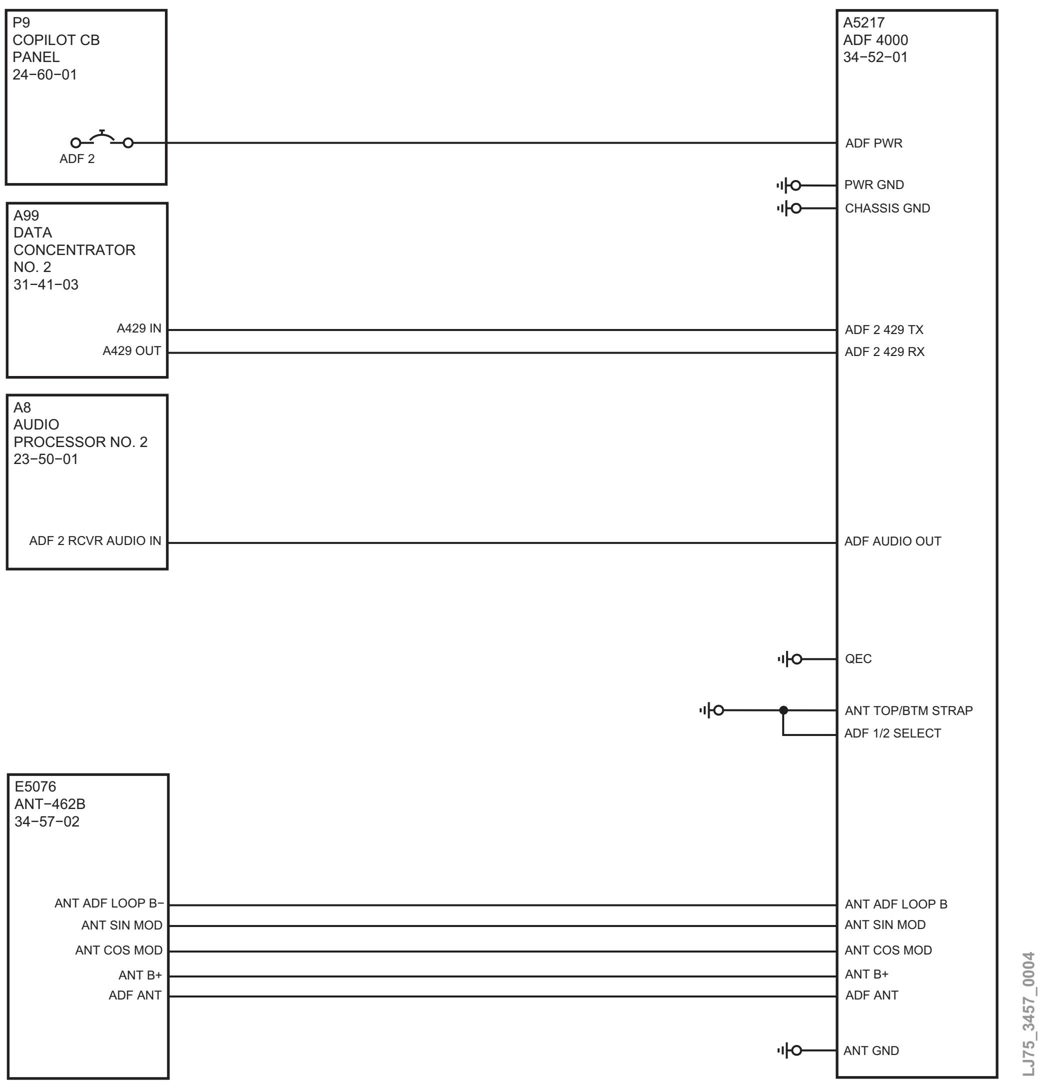


Fig. 69: ADF System Block Diagram (2 of 2)

TABLE OF CONTENTS

MAINTENANCE INFORMATION SYSTEM
(ATA 45-45-00)
- OVERVIEW 1
- COMPONENTS 1
- ASSOCIATED COMPONENTS 1
- COMPONENTS DESCRIPTION AND OPERATION 2
  - Maintenance Data Recorder/Wireless Datalink Unit 2
  - Wireless Datalink Antenna 2
  - Maintenance Connector Panel 3
  - Iridium SATCOM Transceiver 4
  - Iridium SATCOM Antenna 4
- SYSTEM OPERATION 4
  - SD Card 5
  - Maintenance Connector Panel 5
  - Wi-Fi 5
  - Iridium 5
  - Configuration Mode 6
  - OEM Diagnostics 7
  - Screen Save Capability 7
  - System Interfaces 10
  - Signal Interface 10

This page intentionally left blank

MAINTENANCE INFORMATION SYSTEM

(ATA 45-45-00)

OVERVIEW

Data logging and diagnostics acquire aircraft system information through the engine and airframe units, data concentrators, and integrated avionics units using a high-speed data bus (HSDB). Line replaceable units transfer information directly to the MFD for storage.

The data logging and diagnostic capabilities are also referred to as central maintenance computer (CMC) functionality. The CMC functions can be broadly classified into the following categories:

- Event/fault detection and data logging
- Data storage
- Data export/download
- Data viewing (using OEM diagnostics and Garmin CMC viewer)

The maintenance information system (MIS) allows for the line replaceable units that follow:

- Data logging and diagnostics of fault and CMC messages
- Continuous data logging, configurable continuous data logging
- Exceedance capture
- Trend capture
- Service messages
- Lifecycle data

COMPONENTS

- Maintenance data recorder and wireless datalink unit
- Wireless datalink antenna
- Maintenance connector panel

ASSOCIATED COMPONENTS

- Display units (3)
- Remote controllers (2)
- Touch controllers (2)
- Iridium SATCOM transceiver
- Iridium SATCOM antenna

COMPONENTS DESCRIPTION AND OPERATION

Maintenance Data Recorder/ Wireless Datalink Unit

Figure 1

Located forward of the instrument panel, the maintenance data recorder/wireless datalink unit provides 2GB of solid state memory for data logging of select HSDB packets, CAS messages, and CMC messages.

Wireless Datalink Antenna

Figure 1

The antenna is located on top of the fuselage.

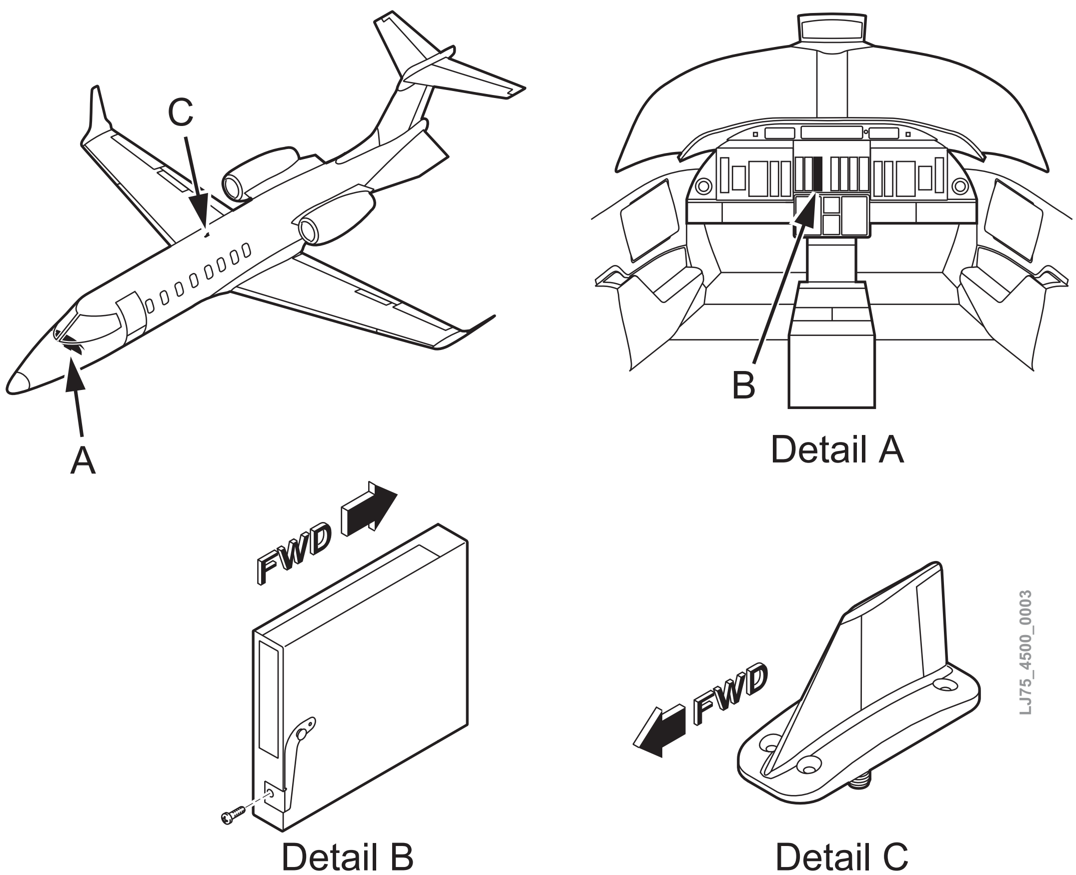


Fig. 1: Maintenance Data Recorder and Wireless Datalink

Maintenance Connector Panel

Figure 2

The maintenance connector panel is located in the cockpit behind an access panel aft of the pedestal. There are two connectors for transmitting and receiving data. The J109 connector allows for transmitting and receiving live data via laptop. The J110 allows for transmitting and receiving logged data.

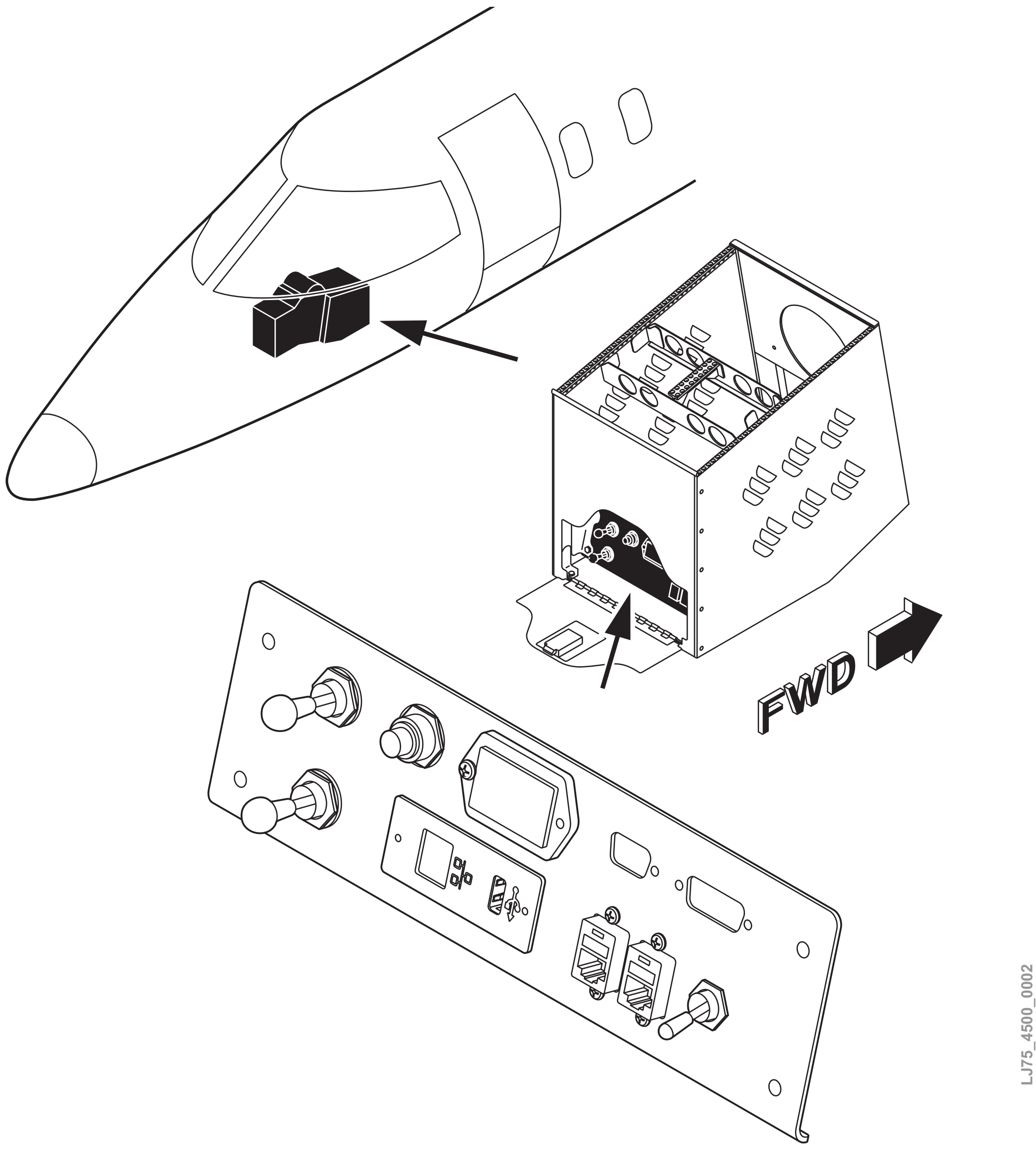


Fig. 2: Maintenance Connector Panel

Iridium SATCOM Transceiver

Figure 3

Located in the avionics nose on the left side at FS142.67, the SATCOM transceiver allows inflight satellite data transfer via the iridium satellite link.

Iridium SATCOM Antenna

Figure 3

The antenna is located on top of the fuselage.

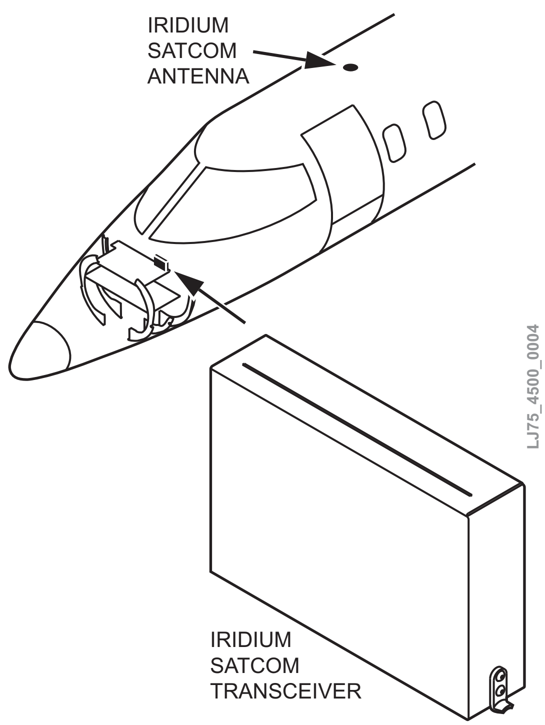


Fig. 3: Iridium SATCOM Transceiver and Antenna

SYSTEM OPERATION

Figures 4

The G5000 system is a highly integrated avionics suite with the capability of handling complex avionics and aircraft system functions. The system provides multiple options to process data and download information from the avionics. This feature is useful for system integration, maintenance, diagnostics, return to service, and in-flight reporting of failure status.

This system collects data from multiple sources. This includes internal avionics parameters; data acquired from aircraft systems, and sensor values.

Multiple data types like discretes, data bus label (A429, RS-485-232, A717, etc.) analogs (RTD, DC volt, potentiometer, and thermocouple) can be processed. The data is packed into the Garmin high-speed data bus (HSDB) protocol before it is processed by the central maintenance computer.

All of the CMC-related data/log/reports are stored in 2 GB internal memory space in the GDU (MFD) which is dedicated CMC memory. The stored logs can be transferred to the GDU external SD card. Wireless data transfer is accomplished using the GDL 59 (Wi-Fi) and/or the GSR 56 (Iridium).

The maintenance information system provides four methods for data transfer:

- SD card
- Maintenance connector panel
- Wi-Fi
- Iridium

SD Card

Data/logs can be copied to an SD card in the top slot of the MFD. Control is provided by the GTC via the password protected maintenance mode. Refer to the AMM 45-45-04 for details.

Maintenance Connector Panel

Live data can be viewed using a laptop. The laptop needs to have Windows XP or later and requires diagnostic express (DX-75) software and an ethernet crossover cable or adapter.

Diagnostic express (DX) assists diagnostic assessments by displaying data from the aircraft's avionics. DX reads HSDB data from the live data (J109). DX is capable of recording a data session for diagnostic analysis. Refer to the AMM 45-45-06 for details.

A pedestal harness P/N 12845-575-005 is provided with the aircraft. This harness is used for clearing brake/flap faults, downloading the DEECs, and configuring the ESIS. On the maintenance connector panel, the pedestal harness is attached to the connectors J159 and J158. A laptop will be connected to the desired connector, depending on what procedure is being done. For brake and flap fault resets, special software called the fault history reset tool is provided. Downloading the DEECs is done using the ECTM/EEI with the DEEC harness attached to the pedestal harness. Configuration of the ESIS is done using the pedestal harness and special software on a laptop hooked up to the ESIS connector. Refer to the AMM for details.

Wi-Fi

The GDL 59 is used for transferring a selected report via Wi-Fi. This is possible when the aircraft is near a Wi-Fi hotspot on the ground. System logs can be configured to transmit alerts on the ground via Wi-Fi. Each aircraft can be assigned an address list for email or text message notifications. Control is provided by the GTC via the password-protected maintenance mode. Refer to the AMM 45-45-00 for details.

Iridium

The GSR 56 is used for data transfer via the Iridium satellite link. The GSR 56 allows for in-flight or on-ground transfer of logs. System logs can be configured to transmit alerts in flight via Iridium. Each aircraft can be assigned an address list for email or text message notifications. The transfer can be set up for automatic transfer or only to be performed manually. Refer to the AMM 45-45-05 for details.

Fig. 4: Maintenance Mode

Configuration Mode

The G5000 system has three modes of operation: normal mode, reversionary mode (see ATA 31-60-76 EFIS), and configuration mode. The system operates in normal mode after standard powerup. For system software loads, configuration settings, troubleshooting, and maintenance, there is a configuration mode provided. When in the configuration mode, configuration pages can help identify a fault by observing the values and symbology in the data fields for various G5000 subsystems and LRUs. Configuration data is loaded to the LRUs from an aircraft-specific Garmin software loader card. Different security levels exist for configuration pages. Most pages contain flight critical information and cannot be accessed using normal methods. Refer to the G5000 Integrated Avionics System Line Maintenance Manual, Section 4 for instructions on how to access configuration mode and to view details of each page.

OEM Diagnostics

Original equipment manufacturer diagnostics (OEMD) provides an overall status, displays logged data, live data from the HSDB, and export data to the SD card in the top slot of the MFD. OEMD diagnostics resides on an SD card and must be in the top slot of the MFD before it is powered. OEMD consists of three screens: main, logged data, system data. The main page gives an overall status for diagnostics only and is not used for return to service. The logged data page allows view of logs, viewing of alerts, saving to the SD card, and clearing logs. The system data page allows viewing of live system data, recording at 1 Hz, and a custom system page that allows viewing parameters from multiple systems.

OEM diagnostics provides the capability to log data during flight. The data can be that contained in prebuilt lists such as:

- GENERAL (all faults and data)
- GENERAL ALERT (general faults)
- PEAK (values are recorded if certain value threshold is exceeded)
- CONTINUOUS (select parameters that are recorded continuously throughout the whole flight
- CAS (CAS related messages)

Several parameters from the different airplane systems are monitored during the flight. Customized lists of this data can be created and downloaded to an external storage devise.

OEMD can be accessed via the password-protected maintenance mode on the GTC or by using the configuration mode. Refer to the G5000 Integrated Avionics System Line Maintenance Manual, Section 4 for details.

Screen Save Capability

The present displays on the GDUs and the GTCs can be saved to an SD card and downloaded to a laptop for further viewing. To save this data, a formatted Sandisk brand SD

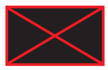
card formatted (FAT-32) with a folder titled “print” must be installed into the top slot of the GDU that is used for saving the display. The GDU must be powered down, the SD card installed, and the GDU powered back up.

Saving the displayed view from a GDU

With the SD card installed into the top slot of the desired GDU, press and hold softkeys 2 and 9 simultaneously for 4 seconds. Wait 30 seconds before doing another view or removing the SD card. The SD card can be removed and the “BMP” files can be downloaded from the “print” folder of the SD card on to a laptop for viewing using the installed picture viewer.

Saving the displayed view from a GTC

With the SD card installed into the top slot of DU 2, press and hold the left side of the middle knob “Copilot COM1 Volume Push: Squelch” label tab on the GTC for 4 seconds. Wait 30 seconds before doing another view or removing the SD card. The SD card can be removed and the “BMP” files can be downloaded from the “print” folder of the SD card onto a laptop for viewing using the installed picture viewer.

INDICATOR	DEFINITION
	The LRU is online and reports that the item located next to the indicator box is communicating.
	The LRU is online, and reports thatorts that the item located next to the indicator box is not communicating.
?	The LRU is not reporting a status for the item located next to the indicator box. This may be because the data is not available, not applicable, or not expected.
N A	The LRU is not reporting status for the item located next to the indicator box. This may be due to the fact that the data is not available or is not expected.
T	“True” condition; i.e., necessary conditions have met in order to activate the item.
F	“False” condition: i.e., necessary conditions have not been met in order to activate the item.
H	“High” condition: i.e., the system expects a high voltage or a high resistance input to trigger the item (fan operation, etc.).
L	“Low” condition: i.e, the system expects a low voltage or a low resistance input to trigger the item (fan operation, etc.).

LJ75_4500_0009

Fig. 5: G5000 System Data Status Indicator Definitions

Fig. 6: G5000 System Messages

System Interfaces

Power

The GDL 59 and the GSR 56 are both powered from the same 5 amp circuit breaker (WI-FI/IRIDIUM) from the left main bus.

The maintenance connector panel is powered from a 7.5 amp circuit breaker (PEDESTAL CONN PWR) from the left main bus.

Signal Interface

Figure 7

Maintenance data is reported to the MIS as follows:

- Pressurization controller via ARINC 429
- Fuel quantity system via ARINC 429
- Brake control unit via discretes, RS-232
- Flap control unit via discretes and analog, RS-232
- L DEEC via, analogs and ARINC 429, RS-422
- R DEEC via, analogs and ARINC 429, RS-422
- Spoileron computer via discretes and ARINC 429, RS-422
- Engine vibration monitor via discretes, ARINC 429
- Nosewheel steering computer via discretes, RS-422

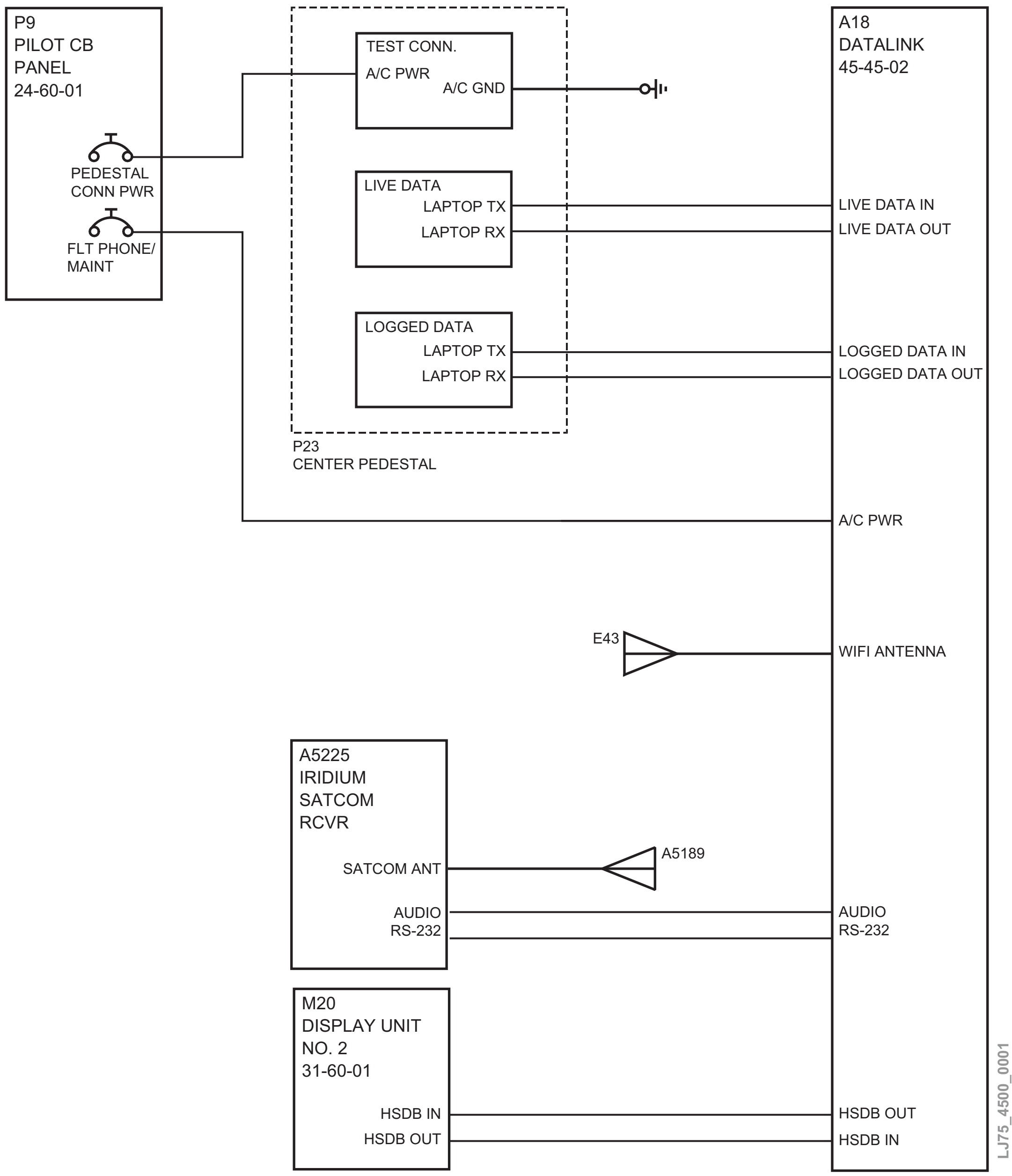


Fig. 7: Maintenance Information System–Block Diagram

This page intentionally left blank

TABLE OF CONTENTS

FLIGHT DECK INFORMATION SYSTEM
(ATA 46-20-00)
OVERVIEW 1
COMPONENTS 2
COMPONENT DESCRIPTION AND OPERATION 2
XM Weather Receiver 2
GPS/WAAS/XM Antenna 4
SYSTEM OPERATION 6
XM–Satellite Weather 6
CONTROL AND INDICATION 8
OVERLAYS AND FUNCTIONS 11
NEXRAD 11
Echo Tops 14
Cloud Tops 16
SiriusXM Lightning 17
Storm Cell Movement 18
SIGMETS and AIRMETS 18
METARS 20
Surface Analysis and City Forecast 22
Freezing Levels 23
Winds Aloft 24
COUNTY WARNINGS 25
Cyclone Warnings 26
Icing (CIP and SLD) 27
Turbulence 28
PIREPs and AIREPs 29
INTERFACES 30
Power 30
SIGNAL INTERFACE 30
FAULT INDICATION 30
INITIAL ACTIVATION/REACTIVATION 30
SYSTEM INTERFACES 31

This page intentionally left blank

FLIGHT DECK INFORMATION SYSTEM

(ATA 46-20-00)

OVERVIEW

Figure 1

The flight deck information system is a subscription-based service that lets crewmembers view weather patterns in full color graphics or text to determine the best route around inclement weather.

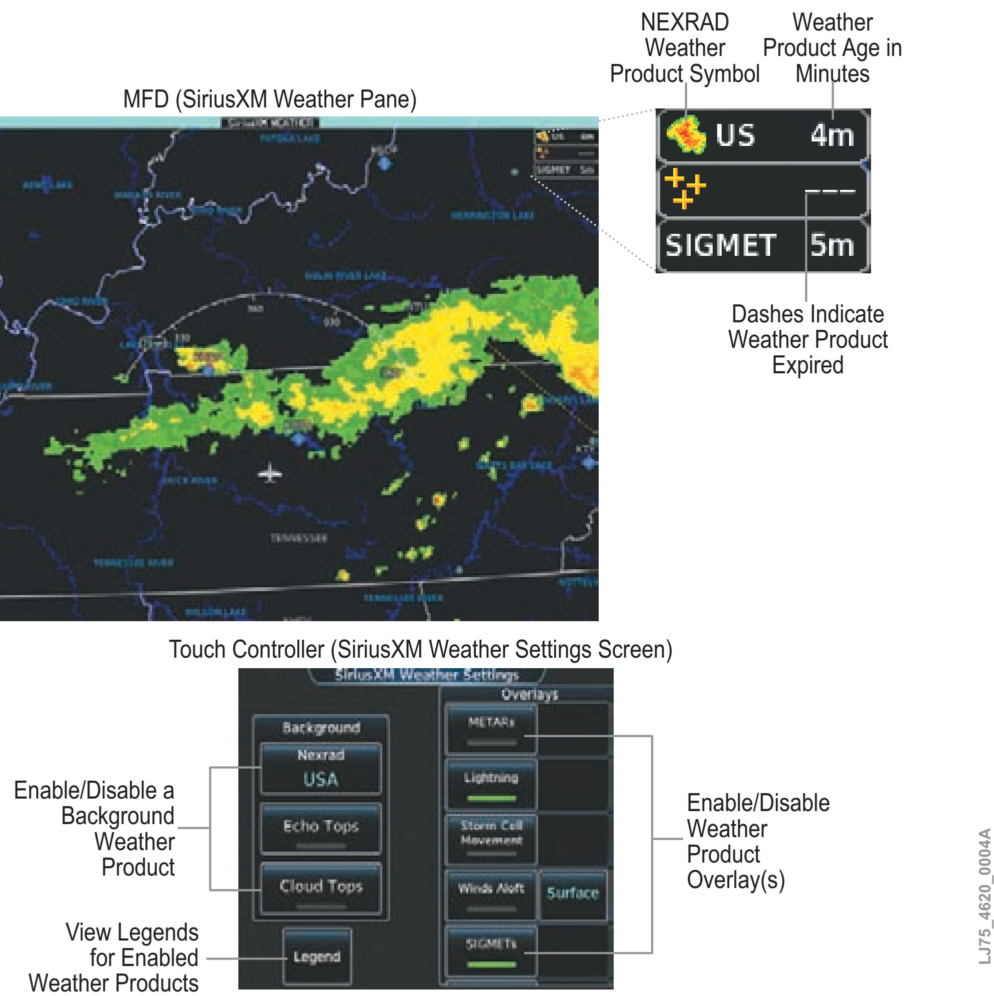


Fig. 1: SiriusXM Weather Products

COMPONENTS

The flight deck information system contains:

- XM weather receiver
- GPS/WAAS/XM antenna

COMPONENT DESCRIPTION AND OPERATION

XM Weather Receiver

Figure 2

Located forward of the instrument panel, the XM weather receiver is an XM weather and radio datalink unit (satellite radio receiver) that provides (throughout North America) real-time weather information to the MFD and PFD Inset Map. The XM weather receiver communicates via HSDB connection. A subscription to the XM satellite service is required to enable the XM capabilities.

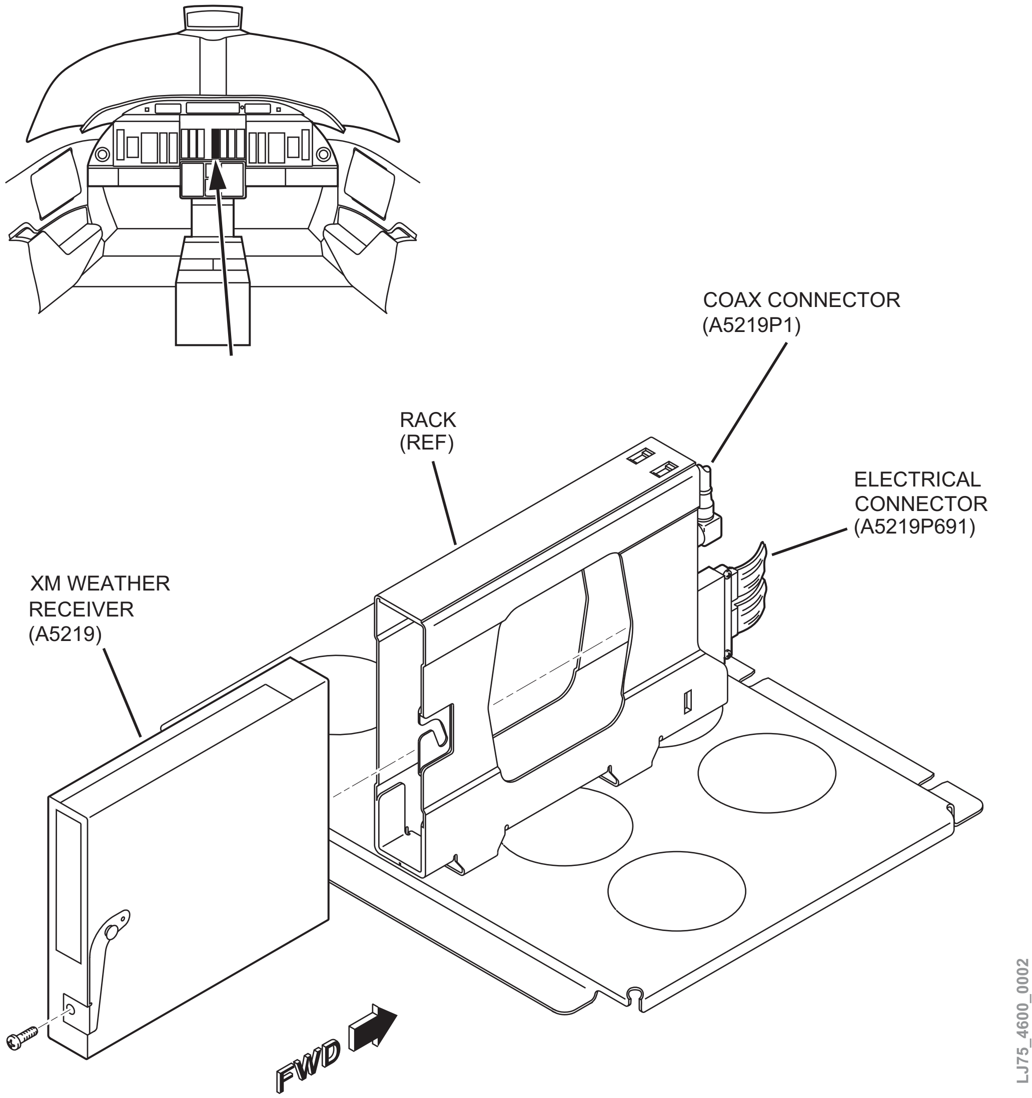


Fig. 2: XM Weather Receiver

GPS/WAAS/XM Antenna

Figure 3

The GPS/WAAS/XM antenna, located on top of the aircraft at FS260 on the left side, provides continuous reception capabilities at any altitude throughout North America. This antenna is also utilized for the no. 1 GPS system.

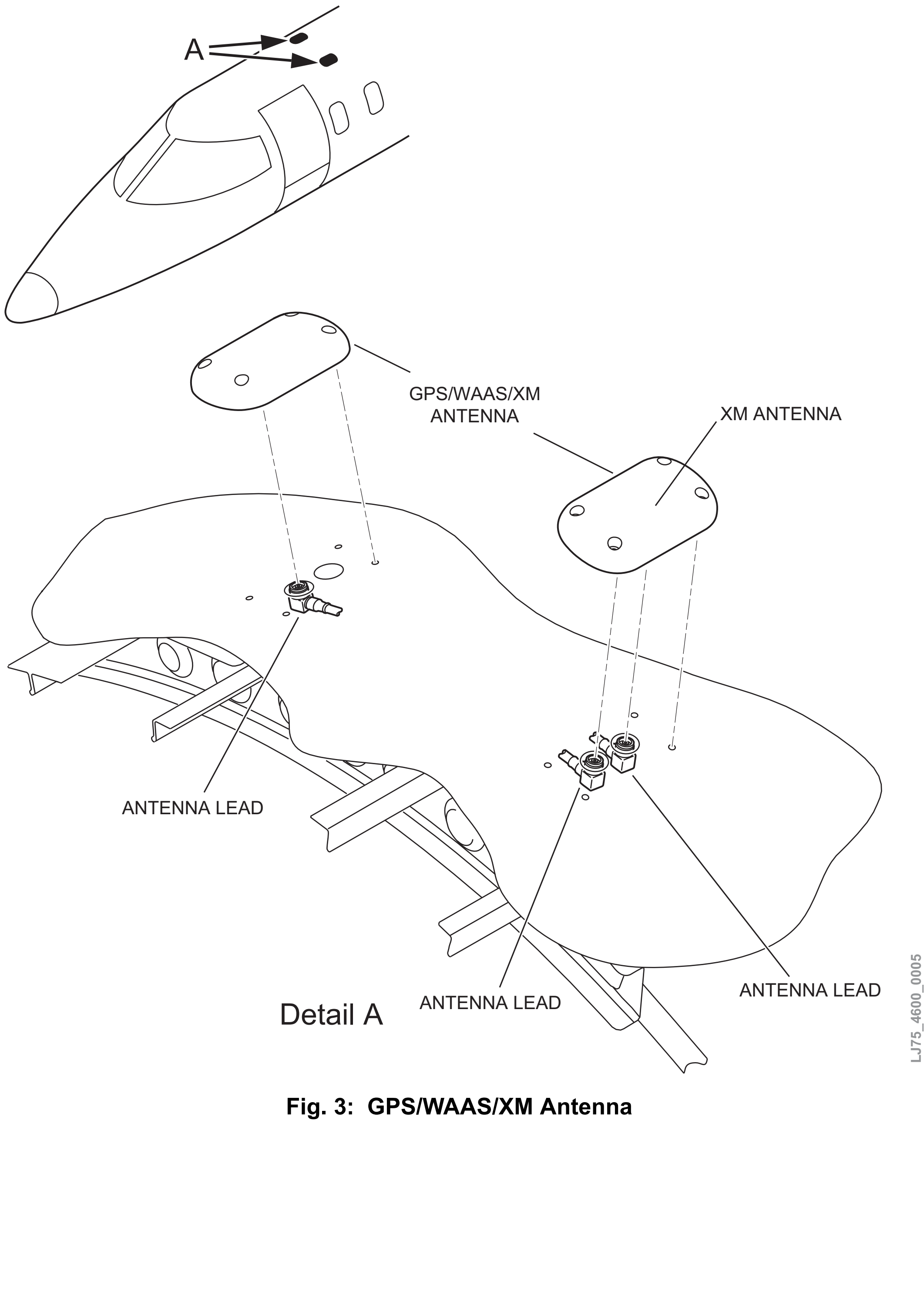


Fig. 3: GPS/WAAS/XM Antenna

SYSTEM OPERATION

XM–Satellite Weather

Figure 4

XM satellite weather information is received by the XM/GPS antenna and is collected and processed by the XM satellite weather receiver.

SiriusXM weather operates in the S-band frequency range to provide continuous downlink capabilities at any altitude throughout the continental United States. Based on the service schedule, the XM weather receiver begins receiving weather updates within 20 minutes of system startup. The XM weather receiver shows the age of reported weather products and the issue time for forecasted weather products.

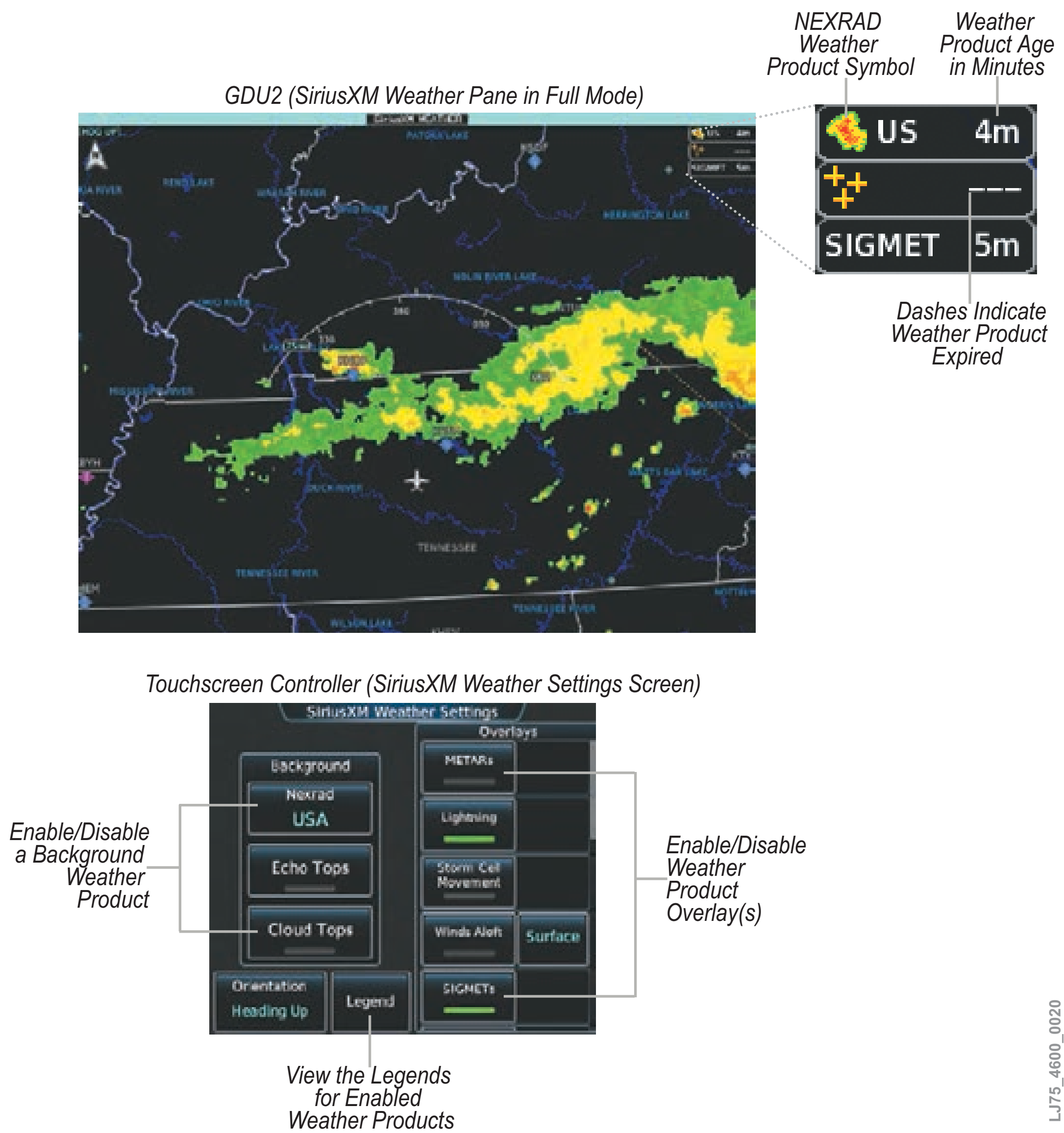


Fig. 4: Viewing SiriusXM Weather Products on the SiriusXM Weather Pane

CONTROL AND INDICATION

The primary control of the Sirius XM function is provided by the GTCs. Each GTC can control two multifunction windows (MFWs). The primary access to the SiriusXM function on the GTCs is done from the Home page. When the optional SiriusXM is installed, the WX radar button is replaced with the weather button. Pressing the weather button defaults to SiriusXM weather MFW as defined by the crew profile function.

The XM weather page allows for the selection of various products, dependent upon the subscriptions. There are three overlays or base functions which are mutually exclusive, as follows:

- NEXRAD
- Echo tops
- Cloud tops

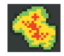
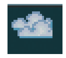
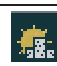
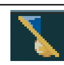
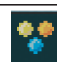
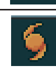
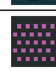
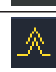
In addition to the three overlays, there are 17 overlay functions dependent upon subscription. Figures 5 shows all 20 overlays and respective capability of being overlaid on the three sources of display.

SiriusXM Weather Product	PFD Inset Navigation Map	Navigation Map Panes	SiriusXM Weather Pane
NEXRAD	+	+	+
No Radar Coverage (Displayed with NEXRAD)	+	+	+
Cloud Tops			+
Echo Tops			+
SiriusXM Lightning	+	+	+
Storm Cell Movement		+	+
SIGMETs/AIRMETs (SIG/AIR)			+
METARs	+	+	+
City Forecast (CITY)			+
Surface Analysis (SFC)			+
Freezing Levels (FRZ LVL)			+
Winds Aloft (WIND)			+
County Warnings (COUNTY)			+
Cyclone Warnings (CYCLONE)			+
Icing Potential (ICNG)			+
PIREPs			+
AIREPs			+
Turbulence (TURB)			+
TFRs	+	+	+
TAFs			+

LJ75_4600_0021

Fig. 5: Weather Product Display Maps

For each enabled SiriusXM weather product, the system displays a weather product icon and product age in the upper right corner of the SiriusXM weather MFW. The product age is the elapsed time (in minutes) since the weather data provider compiled the weather product. The product age display does not indicate the age of the information contained within the weather product, which can be significantly older than the displayed weather product age. The SiriusXM weather service broadcasts weather products at specific intervals (defined in the Broadcast Rate column in Figures 6). If for any reason, a product is not broadcast within the expiration time intervals, the system removes the expired data from the display and shows dashes instead of the product age. This ensures the displayed information is consistent with what is currently being transmitted by the SiriusXM weather service. If more than half of the expiration time has elapsed, the color of the product age changes to yellow. If data for a weather product is not available, the system displays “N/A” next to the weather product symbol instead of the product age.

SiriusXM Weather Product	Product Symbol	Expiration Time (Minutes)	Broadcast Rate (Minutes)
Next-generation Radar (NEXRAD)		30	5 (U.S.) 10 (Canada)
Cloud Tops		60	15
Echo Tops		30	7.5
SiriusXM Lightning		30	5
Storm Cell Movement		30	12
SIGMETs	SIGMET	60	12
AIRMETs	AIRMET	60	12
Meteorological Aerodrome Report (METARs)		90	12
City Forecast		90	12
Surface Analysis		60	12
Freezing Levels		120	12
Winds Aloft		90	12
County Warnings		60	5
Cyclone (Hurricane) Warnings		60	12
Icing Potential (CIP and SLD)		90	22
Pilot Weather Report (PIREPs)		90	12
Air Report (AIREPs)		90	12
Turbulence		180	12
No Radar Coverage	no product image	30	5
Temporary Flight Restrictions (TFRs)	no product image	60	12
Terminal Aerodrome Reports (TAFs)	no product image	60	12

LJ75_4600_0022

Fig. 6: SiriusXM Weather Product Symbols and Data Timing

OVERLAYS AND FUNCTIONS

NEXRAD

Figure 7 and 8

WARNING

DO NOT USE THE INDICATED DATA LINK WEATHER PRODUCT AGE TO DETERMINE THE AGE OF THE WEATHER INFORMATION SHOWN BY THE DATA LINK WEATHER PRODUCT. DUE TO TIME DELAYS INHERENT IN GATHERING AND PROCESSING WEATHER DATA FOR DATA LINK TRANSMISSION, THE WEATHER INFORMATION SHOWN BY THE DATA LINK WEATHER PRODUCT MAY BE SIGNIFICANTLY OLDER THAN THE INDICATED WEATHER PRODUCT AGE.

NOTE

The NEXRAD weather product cannot be displayed at the same time as terrain, echo tops, turbulence, or icing data.

The National Weather Service (NWS) operates the WSR-88D, or NEXRAD (NEXt-generation RADar) system, an extensive network of 156 high-resolution Doppler radar systems. The NEXRAD network provides centralized meteorological information for the continental United States and selected overseas locations. The maximum range of a single NEXRAD site is 250 nm.

Individual NEXRAD sites supply the network with radar images, and the images from each site may arrive at the network at different rates and times. Periodically, the weather data provider compiles the available individual site images from the network to form a composite image, and assigns a single time to indicate when it created the image. This image becomes the NEXRAD weather product. Individual images--gathered from each NEXRAD site--differ in age, and are always older than the displayed NEXRAD weather product age. The data provider then sends the NEXRAD data to the SiriusXM Weather service, whose satellites transmit this information during the next designated broadcast time for the NEXRAD weather product.

Because of the time required to detect, assemble, and distribute the NEXRAD weather product, the displayed weather information contained within the product may be significantly older than the current radar synopsis and may not depict the current weather conditions. The NEXRAD weather product should never be used as a basis for maneuvering in, near, or around areas of hazardous weather regardless of the information it contains.

The display shows composite data from all available NEXRAD radar sites in the selected coverage area (either United States or Canada.) This data is composed of the maximum reflectivity from the individual radar sweeps. The display of the information is color-coded to indicate the strength of the radar returns. All weather product legends can be viewed on the touchscreen controller. For the NEXRAD legend, touch the Legend button when NEXRAD is enabled for display on the SiriusXM Weather Settings screen.

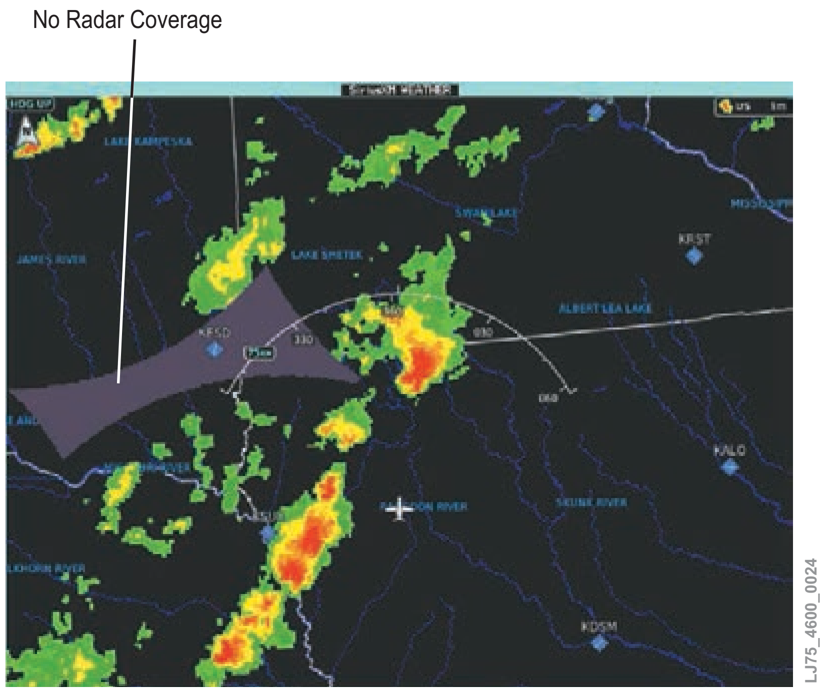


Fig. 7: NEXRAD Data on the SiriusXM Weather Pane

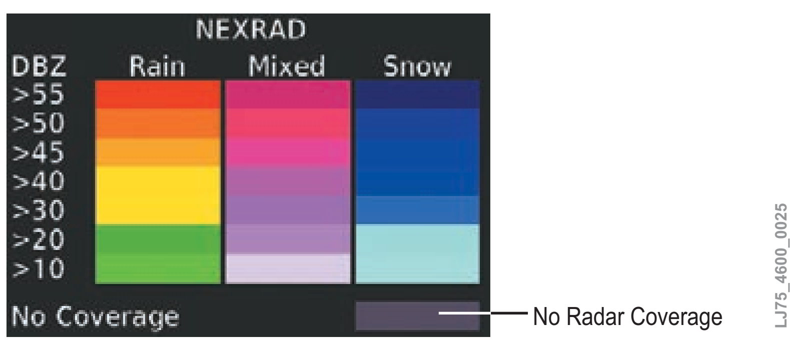


Fig. 8: NEXRAD Reflectivity Legend

The display of no radar coverage is always active when either the NEXRAD or Echo Tops weather products are enabled for display. The following NEXRAD radar coverage and Echo Tops areas are indicated in a gray shade of purple:

- Information is not currently available
- Area outside of the selected coverage source area
- Area information not being collected

Reflectivity

Reflectivity is the amount of transmitted power returned to the radar receiver. Colors on the NEXRAD display are directly correlative to the level of detected reflectivity. Reflectivity as it relates to hazardous weather can be very complex.

The role of radar is essentially to detect moisture in the atmosphere. Simply put, certain types of weather reflect radar better than others. The intensity of a radar reflection is not necessarily an indication of the weather hazard level. For instance, wet hail returns a strong radar reflection, while dry hail does not. Both wet and dry hail can be extremely hazardous.

The different NEXRAD echo intensities are measured in decibels (dB) relative to reflectivity (Z). NEXRAD measures the radar reflectivity ratio, or the energy reflected back to the radar receiver (designated by the letter Z). The value of Z increases as the returned signal strength increases.

NEXRAD Limitations

NEXRAD radar images may have certain limitations:

- NEXRAD base reflectivity does not provide sufficient information to determine cloud layers or precipitation characteristics (wet hail vs. rain). For example, it is not possible to distinguish between wet snow, wet hail, and rain.
- NEXRAD base reflectivity is sampled at the minimum antenna elevation angle. An individual NEXRAD site cannot depict high-altitude storms at close ranges. It has no information about storms directly over the site.
- When zoomed in to a range of 30 nm, each square block on the display represents an area of 4 sq kilometers. The intensity level reflected by each square represents the highest level of NEXRAD data sampled within the area.

The following may cause abnormalities in displayed NEXRAD radar images:

- Ground clutter
- Strobes and spurious radar data
- Sun strobes (when the radar antenna points directly at the sun)
- Interference from buildings or mountains, which may cause shadows
- Metallic dust (chaff) from military aircraft, which can cause alterations in radar scans

NEXRAD Limitations (Canada)

- Radar coverage extends to 55ºN
- Any precipitation displayed between 52ºN and 55ºN is displayed as mixed regardless of actual precipitation type

Echo Tops

Figure 9 and 10

NOTE

When the Echo Tops product is enabled, NEXRAD and Cloud Tops data are removed.

The Echo Tops weather product shows the location, elevation, and direction of the highest radar echo. The highest radar echo does not indicate the top of a storm or clouds; rather it indicates the highest altitude at which precipitation is detected. Information is derived from NEXRAD data.

Touch the Legend button on the SiriusXM Weather Settings screen to display the Echo Tops legend when Echo Tops is enabled. Since Echo Tops and Cloud Tops use the same color scaling to represent altitude, only one of these products may be displayed at a time. When Echo Tops is enabled, the system disables NEXRAD and Cloud Tops information.

The display of no radar coverage is always active when either NEXRAD or Echo Tops is selected. Areas where NEXRAD radar coverage and Echo Tops information is not currently selected, not available, or is not being collected, are indicated in gray shade of purple.

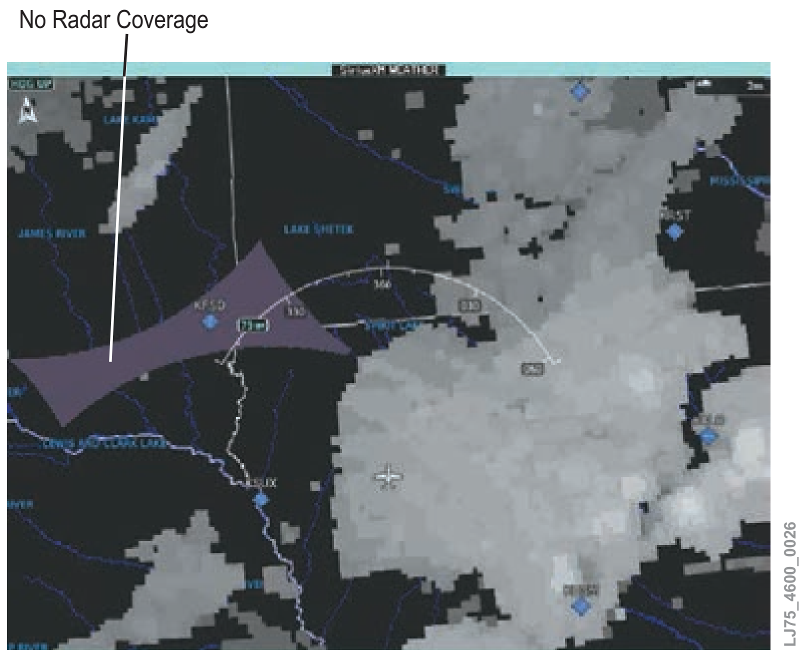


Fig. 9: Echo Tops Weather Product

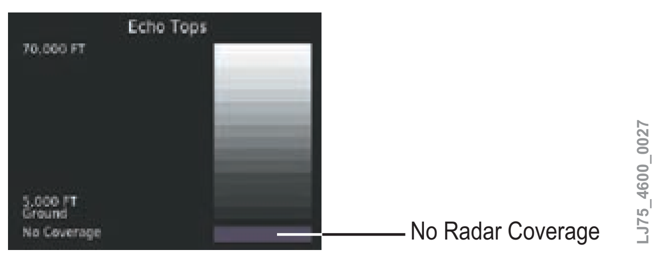


Fig. 10: Echo Tops Legend

Cloud Tops

Figure 11 and 12

NOTE

The Cloud Tops and Echo Tops weather products cannot be displayed at the same time.

The Cloud Tops weather product depicts cloud top altitudes as determined from satellite imagery. When the Cloud Tops background is enabled, the system disables Echo Tops data.

Touch the Legend Button on the SiriusXM Weather Settings Screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch Back or Home.

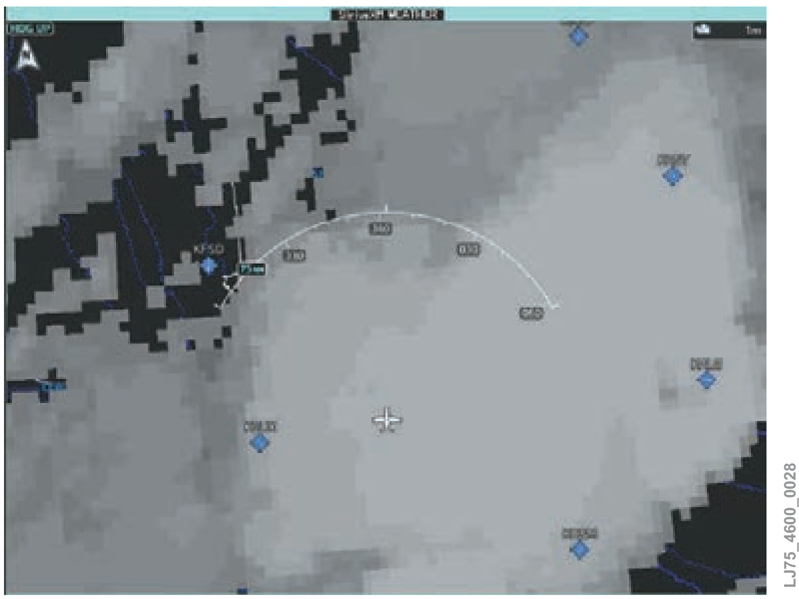


Fig. 11: Cloud Tops Weather Product

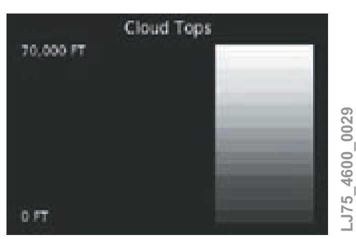


Fig. 12: Cloud Tops Legend

SiriusXM Lightning

Figure 13

The Lightning weather product shows the approximate location of cloud-to-ground lightning strikes. A strike icon represents a strike has occurred within a 2-km region. The exact location of the lightning strike is not displayed.

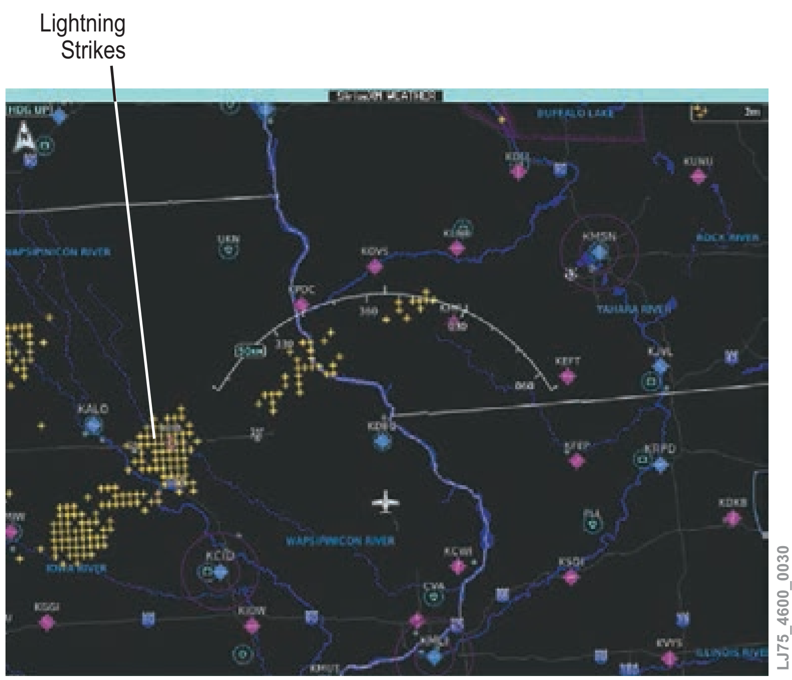


Fig. 13: SiriusXM Lightning Weather Product

Storm Cell Movement

Figure 14

The Cell Movement map overlay shows the location and movement of storm cells as identified by the ground-based system. Yellow squares represent cells, with short orange arrows indicating direction of cell movement.

SIGMETS and AIRMETS

Figure 15 through 18

The National Weather Services issues SIGMETs (SIGnificant METeorological Information) and AIRMETs (AIRmen's METeorological Information) for potentially hazardous weather. The service issues a Convective SIGMET for hazardous convective weather. A localized SIGMET is a significant weather condition occurring at a localized geographical position.

Touch the Legend button on the SiriusXM Weather Settings screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch Back or Home.

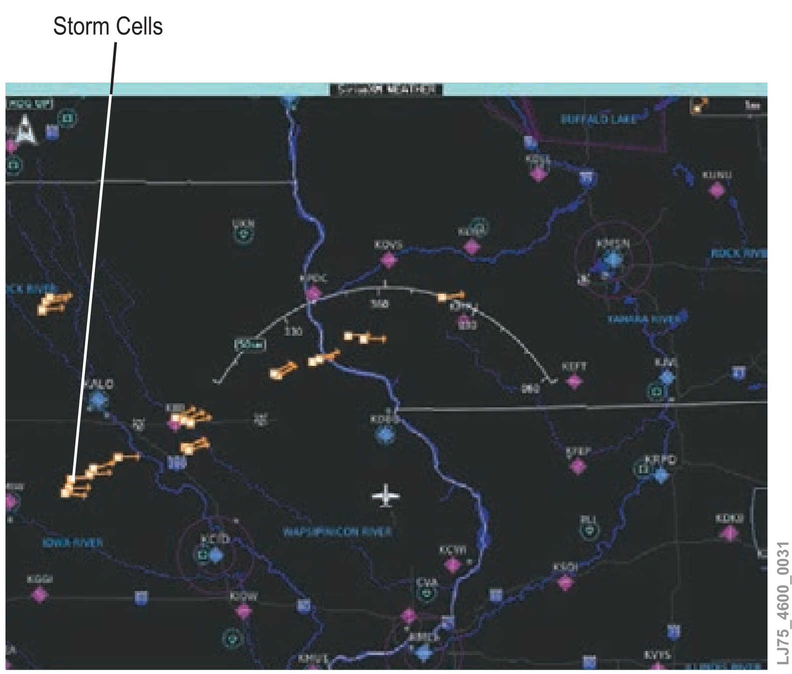


Fig. 14: Storm Cell Movement Weather Product

Fig. 15: AIRMET and SIGMET Weather Products

Fig. 16: Map Pointer Options Screen

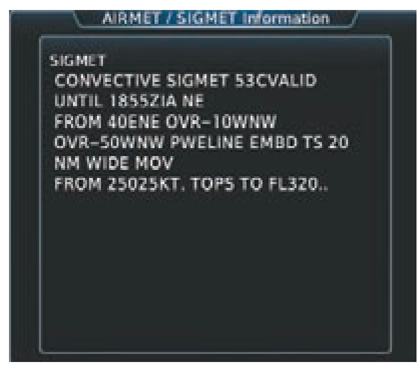


Fig. 17: AIRMET/SIGMET Info Screen

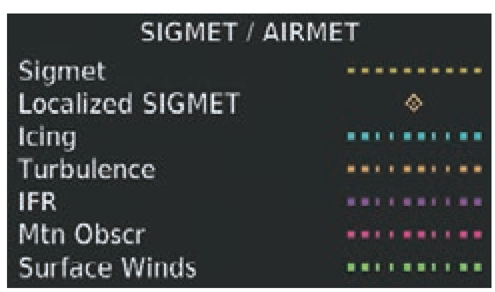


Fig. 18: SIGMET/AIRMET Legend

METARS

Figure 19 and 20

NOTE

Atmospheric pressure as reported for METARs is given in hectopascals (hPa), except for in the United States, where it is reported in inches of mercury (in Hg). Temperatures are reported in Celsius.

NOTE

METAR information is only displayed within the installed navigation database service area.

METARs (METeorological Aerodrome Reports) describe observed weather conditions at airports and reporting stations. METARs are generally updated hourly, but may be updated more frequently if conditions warrant. METARs typically contain information about the temperature, dewpoint, wind, precipitation, cloud cover, cloud heights, visibility, and barometric pressure. They can also contain information on precipitation amounts, lightning, and other critical data. METARs are shown as colored flags at airports that provide them.

Textual METAR information is also available on the Airport Information screens on the touchscreen controllers. When viewing the Airport Information screen for an airport, touch the Weather tab and scroll as needed to view the METAR text. METAR text is also available on the Takeoff Data and Landing Data screens; refer to the Flight Management section for more information about viewing METAR information on these screens.

The graphical METAR flag color shown on the maps is determined by the information in the METAR text. The system displays a gray METAR flag when the METAR text does not contain adequate information to determine the METAR category.

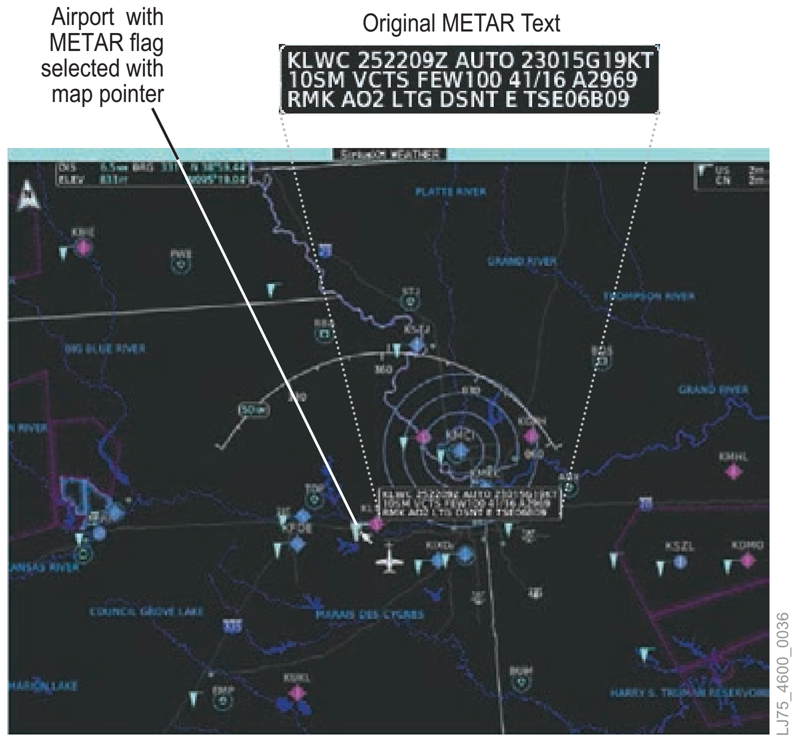


Fig. 19: Panning on the SiriusXM Weather Pane

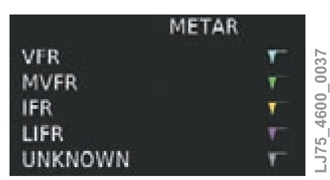


Fig. 20: METAR Legend

Surface Analysis and City Forecast

Figure 21 and 22

NOTE

Surface Analysis and City Forecast data are displayed only within the installed Aviation Database service area.

The Surface Analysis and City Forecast weather products are available for current and forecast weather conditions. Forecasts are available for intervals of 12, 24, 36, and 48 hours.

Touch the Legend button on the SiriusXM Weather Settings screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch Back or Home.

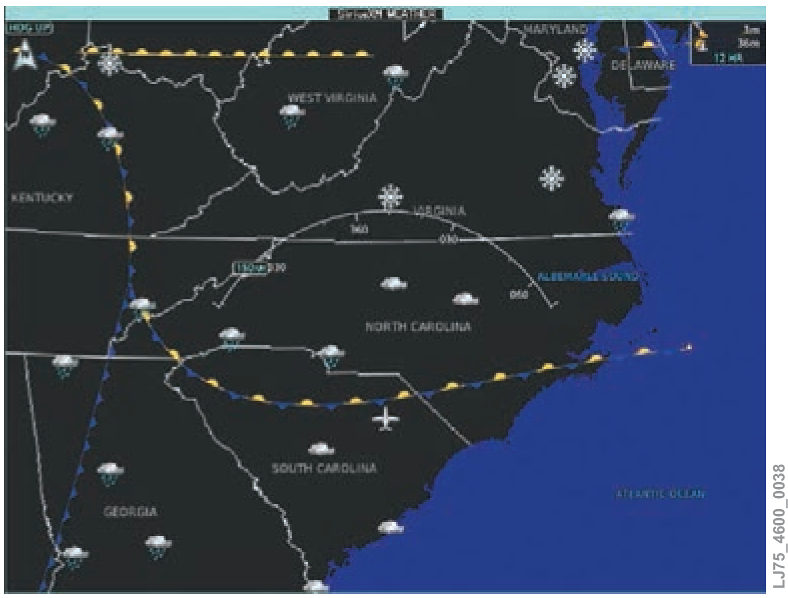


Fig. 21: Current Surface Analysis Weather Product

Fig. 22: Surface Analysis and City Forecast Legend

Freezing Levels

Figure 23 and 24

Freezing Level data shows the color-coded contour lines for the altitude and location at which the first isotherm is found. When no data is displayed for a given altitude, the data for that altitude has not been received, or is out of date and has been removed from the display.

Touch the Legend button on the SiriusXM Weather Settings screen to display weather legend(s) for enabled weather product(s). Scroll as necessary to view the information, then touch Back or Home.

Fig. 23: Freezing Level Weather Product

Fig. 24: Freezing Level Legend

Winds Aloft

Figure 25

The Winds Aloft weather product shows the predicted windspeed and direction at the surface and at selected altitudes. Altitude can be displayed in 3000-ft increments from the surface up to 42,000 ft MSL.

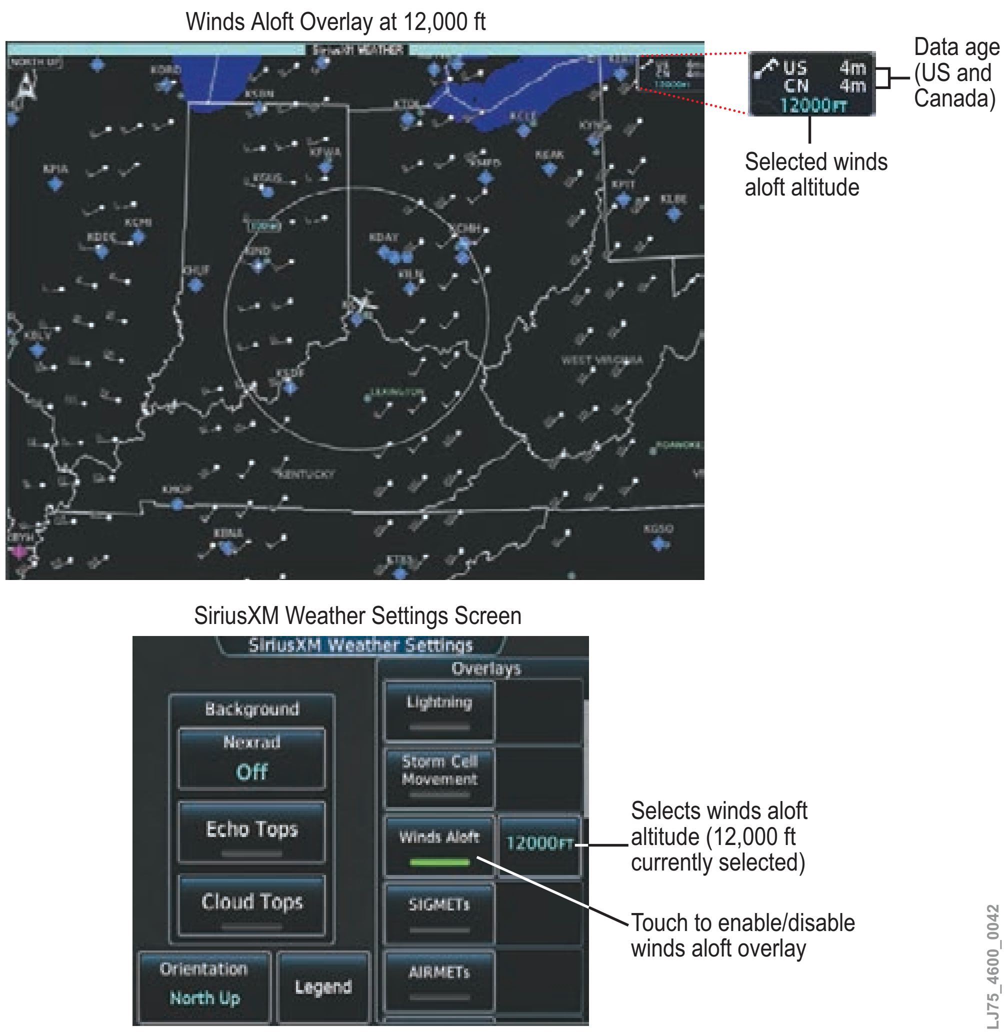


Fig. 25: Displaying Winds Aloft Data

COUNTY WARNINGS

Figure 26

County data provides specific public awareness and protection weather warnings from the National Weather Service (NWS). This can include information on severe thunderstorms, tornadoes, and flood conditions.

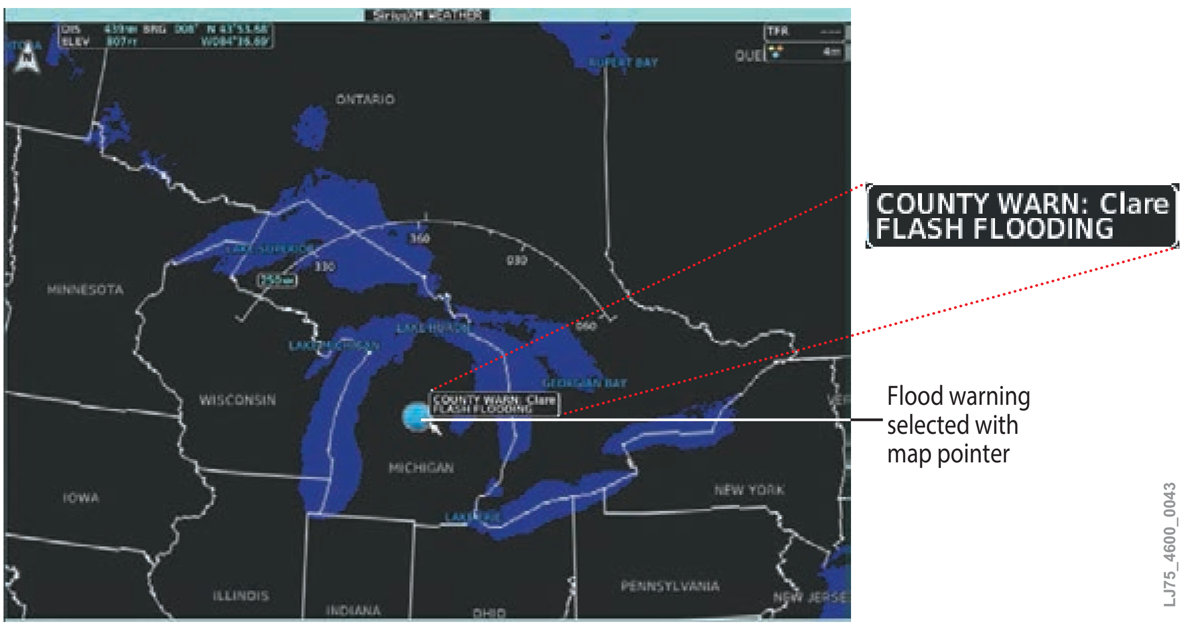


Fig. 26: County Warnings Weather Product

Cyclone Warnings

Figure 27

The Cyclone weather product shows the current location of cyclones (hurricanes), tropical storms, and their projected tracks.

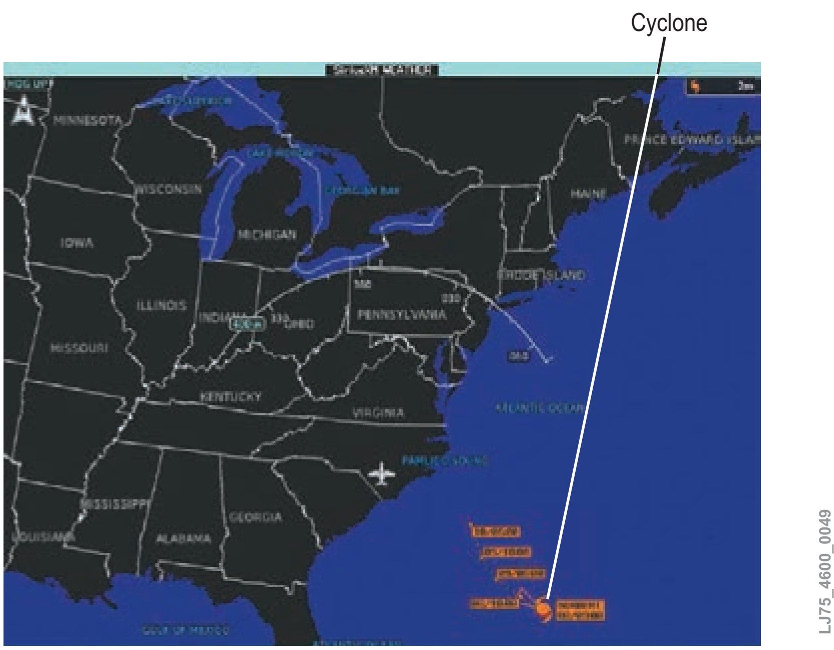


Fig. 27: Cyclone (Hurricane) Weather Product

Icing (CIP and SLD)

Figure 28

NOTE

Icing data cannot be displayed at the same time as NEXRAD data.

Current Icing Product (CIP) data shows a graphical view of the icing environment. Icing severity is displayed in four categories: light, moderate, severe, and extreme (not specific to aircraft type). The CIP product is not a forecast, but a presentation of the current conditions at the time of the analysis.

Supercooled large droplet (SLD) icing conditions are characterized by the presence of relatively large, supercooled water droplets indicative of freezing drizzle and freezing rain aloft. SLD threat areas are depicted as magenta dots over the CIP colors.

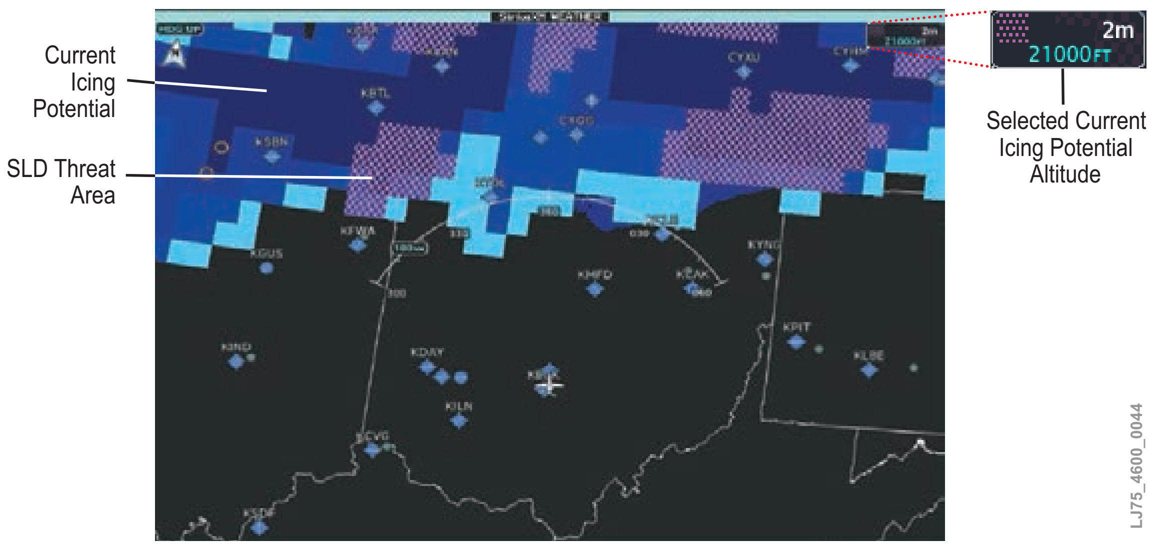


Fig. 28: Current Icing Potential Overlay at 21,000 Ft

Turbulence

Figure 29 and 30

NOTE

The Turbulence weather product cannot be displayed at the same time as NEXRAD weather product.

The Turbulence weather product identifies the potential for erratic movement of high-altitude air mass associated winds. Turbulence is classified as light, moderate, severe or extreme, at altitudes between 21,000 and 45,000 ft. Turbulence data is intended to supplement AIRMETs and SIGMETs.

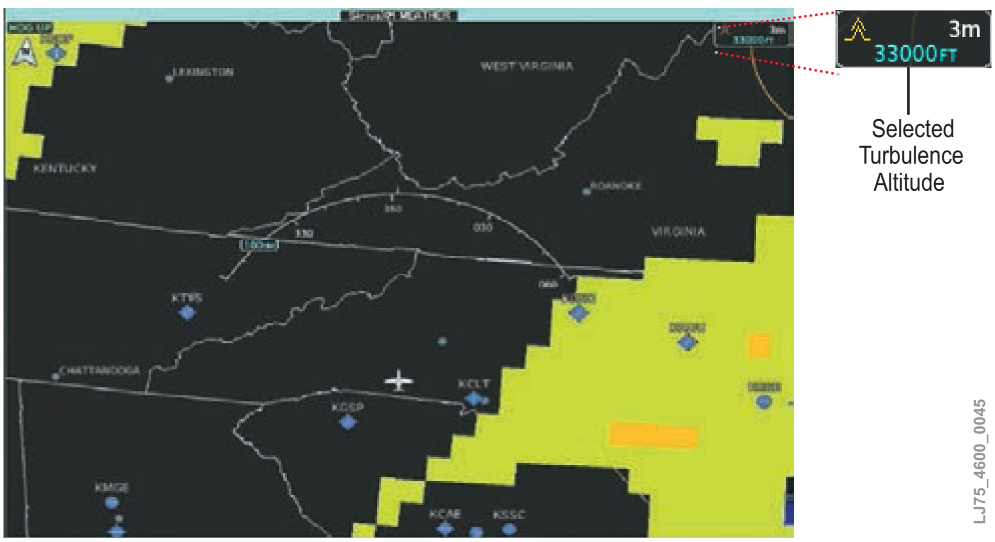


Fig. 29: Turbulence Weather Product at 21,000 Ft

Fig. 30: Turbulence Legend

PIREPs and AIREPs

Figure 31 and 32

Pilot weather reports (PIREPs) provide weather observations collected from pilots. When significant weather conditions are reported or forecast, Air Traffic Control (ATC) facilities are required to solicit PIREPs. A PIREP may contain adverse weather conditions, such as low inflight visibility, icing conditions, windshear, and turbulence. PIREPs are issued as either routine (UA) or urgent (UUA).

Another type of PIREP is an air report (AIREP). AIREPs are used almost exclusively by commercial airlines.

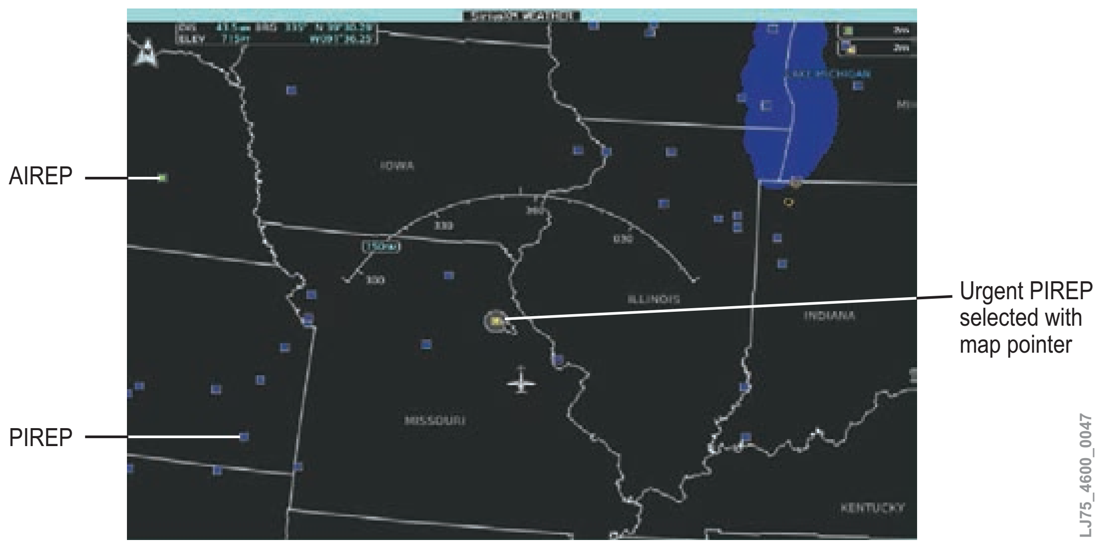


Fig. 31: AIREPs and PIREPs on the SiriusXM Weather Pane

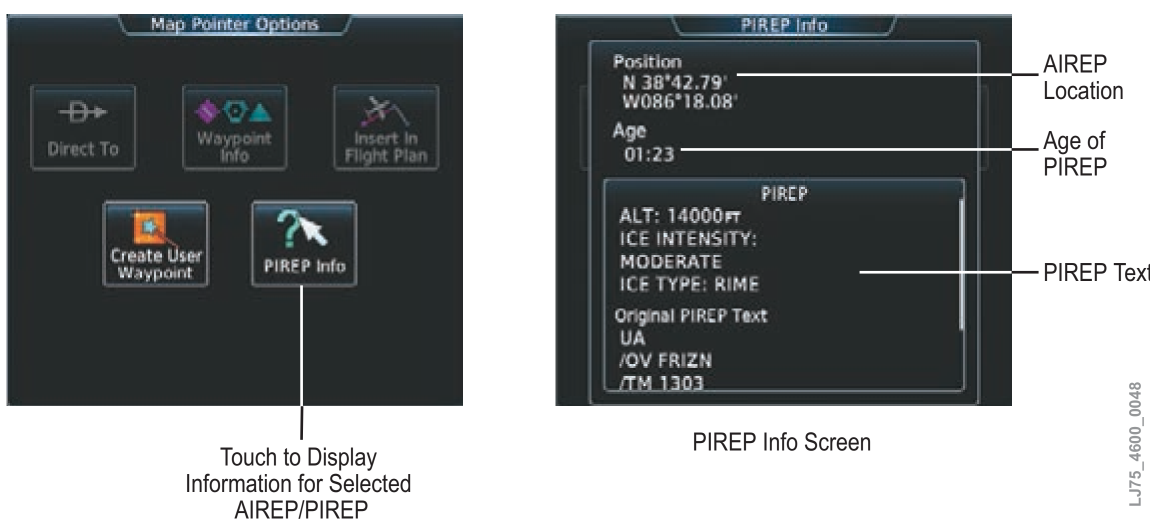


Fig. 32: Displaying PIREPs/AIREPs on the Touchscreen Controller

INTERFACES

Power

The XM satellite weather receiver is powered through the L MAIN bus.

SIGNAL INTERFACE

The XM weather receiver interfaces with DAU 5 via HSDB. The XM weather receiver interfaces with the # 1 GPS/WAAS/XM weather antenna.

FAULT INDICATION

Table 1: XM Satellite System— CAS Messages

CAS MESSAGE	DESCRIPTION
XM FAIL	GDL 69 failed

INITIAL ACTIVATION/ REACTIVATION

Figure 33

Before SiriusXM weather can be used, the service must be activated by providing the coded IDs unique to the installed XM weather receiver to SiriusXM customer service. The SiriusXM weather service has a coded data radio ID. The data radio ID must be provided to activate the weather service. The activation is completed on the SiriusXM Info page (Figures 33) accessed through Home, Utilities, Setup, and then SiriusXM Info on the GTCs.

Fig. 33: SiriusXM Info Screen

SYSTEM INTERFACES

Figure 34

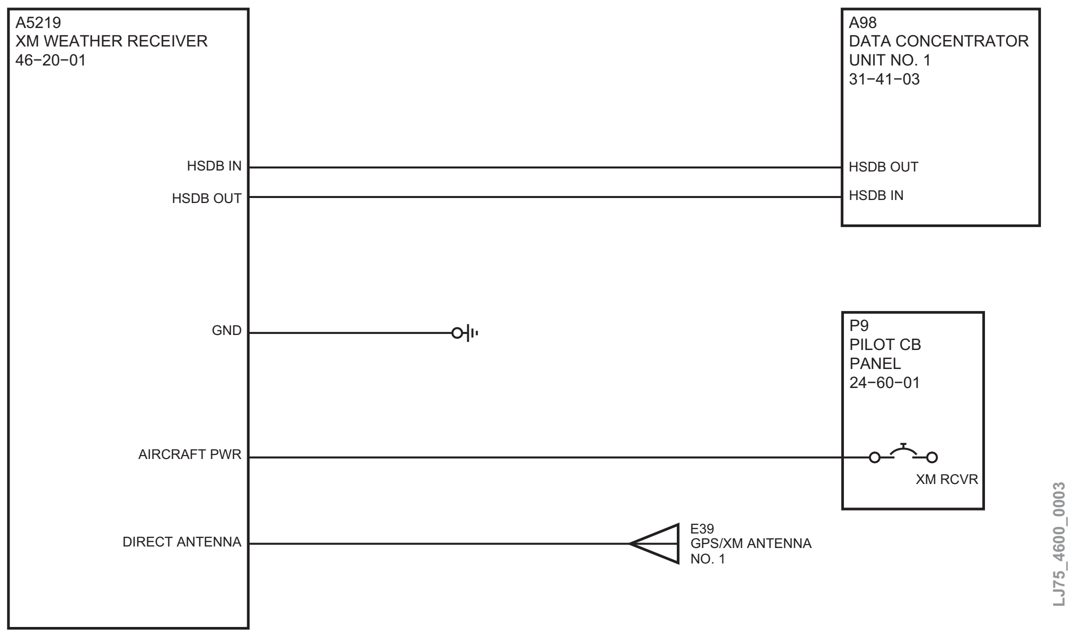


Fig. 34: Flight Deck Information System Block Diagram

This page intentionally left blank